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Botany

FLORA COSTARICENSIS

William Burger, Editor

Family #39 Orchidaceae: Tribe Maxillarieae: Subtribes Maxillariinae and Orcidiinae

John T. Atwood Dora Emilia Mora de Retana

April 30, 1999 Publication 1500

PUBLISHED BY FIELD MUSEUM OF NATURAL HISTORY

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FIELDIANA

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FLORA COSTARICENSIS

William Burger, Editor

Family #39 Orchidaceae: Tribe Maxillarieae: Subtribes Maxillariinae and Oncidiinae

John T. Atwood

Director, Orchid Identification Center Marie Selby Botanical Gardens 811 South Palm Avenue Sarasota, Florida 34236 U.S.A. Research Associate
Department of Botany
Field Museum of Natural History
Roosevelt Road at Lake Shore Drive
Chicago, Illinois 60605-2496
U.S.A.

Dora Emilia Mora de Retana

Director, Lankester Gardens Universidad de Costa Rica Escuela de Biología San José 1000, Costa Rica

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Dedication

Costa Rica has a proud history of enlightened botanists, both native- and foreign-born. This volume is dedicated to A. R. Endrés, a little-known but productive plant collector and illustrator who died in 1877. Almost nothing is known about him, and he may not have been Costa Rican. What we do know is that he left copious specimens and was one of the most precise illustrators of minute orchids. His last name is Spanish, yet he wrote his notes in English. He was referred to as a "half-caste" (Veitch, J. H. Hortus Veitchii, 1906), a label that may indicate parentage of a North American or European and a Latin American. Most of the specimens were ignored during Reichenbach's

life, but some of these were actually new species only recently described by C. A. Luer (Lindleyana 10:133–173. 1995). Examination of Endrés' drawings under a dissecting microscope reveals incredibly close shade lines that could be accomplished only by an unusually steady hand. Still more unbelievable was his ability to accurately observe minute details of some of the tiniest orchid flowers. As Reichenbach stated, he was "one of those collectors who cared more for science than for sovereigns" (Gard. Chron. 19:432. 1883). The life work of Endrés is preserved at the Reichenbach Herbarium (w) of the Naturhistorisches Museum, Vienna, Austria.

Introduction

This is the first of a series treating the Orchidaceae for Flora Costaricensis. It represents the collaborative efforts between authors of very different experience, backgrounds, and cultures, which we believe have complemented one another in the finished product. Usually, such products are made either by a native in the tropics with little access to original materials or by botanists from northern countries with limited access to live material. This product combines the assets of botanists from both perspectives. Germán Carnevali provided the treatment of *Cryptocentrum* using his valuable doctoral dissertation, and Franco Pupulin provided treatments of *Macroclinium* and *Trichocentrum* with D. E. Mora.

This volume features two subtribes, Maxillariinae and Oncidiinae, according to the classification of R. L. Dressler (1981, see references cited within both subtribes). Two hundred twenty-nine species, or about one-fifth of Costa Rican Orchidaceae, are treated. These are among the most conspicuous of Costa Rica's epiphytic orchids, and therefore this treatment should have broad utility among scientists, horticulturists, and the lay public. We are particularly confident in the contribution of two large genera, Maxillaria (107 species treated) and Oncidium (28 species treated), with many previously confused, misapplied, and superfluous names. This work is based on all available specimens examined from AMES, CR, D, F, INB, MO, and US, supplemented by specimens from herbaria mentioned in the Acknowledgments. Types have been examined as far as is practical, but our access to types has been primarily through microfiche collections of the Ames Herbarium at Harvard University, the Lindley Herbarium at Kew, and the Reichenbach Herbarium in Vienna. In the text, these are indicated as "photo seen." The senior author also has made several trips to the Ames Herbarium in search of types, and one trip to Kew and Vienna. Most of the Maxillariinae have been catalogued on AMO-DATA and will be converted to TROPICOS. Specimens of Oncidiinae continue to be catalogued directly on TROPICOS.

To clarify nomenclature, several specimens are selected as lectotypes or neotypes, and one is selected as an epitype. Neotypes are selected for Maxillaria acostae Schltr. (AMES), M. piestopus Schltr. (AMES), M. rouseauae Schltr. (MO), and Ornithidium wercklei Schltr. (AMES). Lectotypes are selected for M. acervata Rchb. f. (w), M. ringens Rchb. f. (W), Oncidium fulgens Schltr. (AMES), Oncidium globuliferum Kunth var. costaricense Rchb. f. (W), Oncidium naranjense Schltr. (AMES), Oncidium warscewiczii Rchb. f. (W), Ornithidium costaricense Schltr. (AMES), and Ornithidium tonduzii Schltr. (US). An epitype is selected for M. pachyacron Schltr. (SEL) to serve as a reference specimen for interpreting Schlechter's original description and drawings. These names can be found in the Index.

Many of the individual species descriptions are based on Icones Plantarum Tropicarum (series 1), fascicles 14, 15, and 16. Many more specimens have been examined since the appearance of these works, with subsequent modification of the text.

More than 92% of the species in this volume

are illustrated. The illustrations are organized according to their occurrence in the key rather than alphabetically, which we believe will facilitate determination when consulted with the key. The individual species treatments, which are arranged alphabetically, may be consulted as indexes.

Acknowledgments

We thank the herbarium staffs of the Oakes Ames Herbarium of Harvard University (AMES), Museo Nacional (CR), Field Museum of Natural History (F), Instituto de Biodiversidad (INB), Missouri Botanical Garden (MO), Selby Gardens (SEL), National Herbarium (us), and Universidad de Costa Rica (USJ) for general support in this project and for providing access to collections. We also thank several other herbaria and their curators for loans, some of which have been borrowed for more than 10 years. These include Duke University (DUKE), Michigan State University (MSC), the University of Michigan (MICH), New York Botanical Garden (NY), and the University of Texas (TEX). Special thanks are extended to the Missouri Botanical Garden, which has supported the botanical efforts of Selby Botanical Gardens from the beginning. We especially thank Peter Raven, the director, as well as members of his staff. Michael Grayum and Barry Hammel supported the project from its initiation in 1988. William Haber provided much logistic support, as well as assistance in field efforts in the Monteverde region, and served as a knowledgeable and enthusiastic field companion. William Burger of the Field Museum has supported the project from the beginning.

There are too many modern collectors to thank for herbarium collections, but we would like to acknowledge some notable historical collectors: A. Alfaro, A. Brenes, A. R. Endrés, O. Jiménez, C. Lankester, P. Standley, and J. Valerio. Alexander Skutch, thankfully still with us, is the last of these illustrious collectors. Much of the Selby herbarium is based on an excellent collection of Costa Rican Orchidaceae assembled by L. O. Williams.

We have many notable botanists to thank for annotating the specimens before us. In particular, we thank Louis O. Williams, Charles Schweinfurth, and Oakes Ames. Bob Dressler reviewed specimens of the Oncidiinae before us.

Dora E. Mora thanks Joaquín García for sharing locality data and vegetative material and for

valuable comments on the manuscript of the Oncidiinae. She also thanks Maria del Carmen Calvo for secretarial assistance.

John T. Atwood thanks W. J. Kress of the National Museum of Natural History (US) for encouragement in the project and D. H. Nicolson for sharing his expertise regarding application of names, for helping us solve a variety of difficult nomenclatural problems, and especially for sharing his philosophy of the use of types.

We thank Calaway H. Dodson for fruitful discussions and for the use of several illustrations from Icones Plantarum Tropicarum. Robert L. Dressler freely shared his research on Costa Rican Oncidiinae with us, notably concerning the genera Notylia and Sigmatostalix. Germán Carnevali provided the treatment of Cryptocentrum. Franco Pupulin provided treatments of Macroclinium and Trichocentrum with D. E. Mora. Lastly, Joaqín García-Castro provided a treatment of Leucohyle with D. E. Mora as an Addendum.

Special thanks are extended to curators of two European herbaria. Phillip Cribb and Jeff Wood granted free access to the herbarium at Kew, and Harald Riedl was most helpful by making available the extensive Reichenbach and Kränzlin collections at the Naturhistorisches Museum in Vienna, Austria.

We thank the many artists who worked with us over the several years it took to complete this work, notably Omar Achí, Luís Alfaro, G. Barboza, B. N. Culbertson, Carmen Marín, Stig Dalström, and Willow Zuchowski.

Lastly, we thank our institutions, Marie Selby Botanical Gardens and the University of Costa Rica, for allowing us salaried time to write this volume and to do the necessary field and library research leading to it.

This material is based on work supported by the National Science Foundation (NSF) and by the Office of Forestry, Environment, and Natural Resources, Bureau of Science and Technology, of the U.S. Agency for International Development (NSF grant DEB-9200812).

FLORA COSTARICENSIS Family #39 Orchidaceae

ORCHIDACEAE

By John T. Atwood and Dora Emilia Mora de Retana

Subtribe Maxillariinae Benth.

REFERENCES—R. L. Dressler, The Orchids. Harvard University Press, Cambridge, Massachusetts, and London, England, 332 pp. 1981. R. L. Dressler, Phylogeny and Classification of the Orchid Family. Dioscorides Press, Portland, Oregon, 314 pp. 1993. L. O. Williams, An enumeration of the Orchidaceae of Central America, British Honduras and Panama. Ceiba 5:1–256, 1956.

Plant usually epiphytic, or opportunistically terrestrial, cespitose or rhizomatous, sometimes with rhizomes forming upright canes, sympodial or less commonly monopodial, sometimes sympodial as juveniles and monopodial as adults; roots with a white velamen, of varying maximum diameter depending on the species, decurrent on upright stems. Pseudobulb present or absent, when present of a single internode, usually compressed, sometimes grooved, always terminating the shoot. Leaves articulate or rarely secondarily lacking articulations, always conduplicate, rarely equitant, distributed along the rhizome as well as at the pseudobulb apex or restricted to the pseudobulb apex, usually distichous and very rarely spiraled. Inflorescence short or long, lateral on the stem, at the base of the pseudobulb if present, always a single-flowered scape, sometimes formed in clusters (fascicles) within each rhizome bract of what appear to be very condensed, aborted, vegetative shoots. Flowers exhibiting a great deal of variability, spreading or campanulate, of various colors including green and brown, fragrant or not. Sepals free or variously connate, especially the lateral sepals, sometimes forming a spur. Petals usually similar to the sepals. Lip fixed or hinged to the receptacle or column foot, simple to 3-lobate, variously adorned with calli and hairs. Column usually cylindric, straight or more commonly arcuate, sometimes adorned with wings (Cryptocentrum); pollinia 4, dorso-ventrally superposed in 2 pairs, supported on a well-defined viscidium and usually a stipe. Fruit a capsule.

A Neotropical subtribe of 460-500 species contained in eight genera (recognizing *Maxillaria*, sensu lato). Four genera with a total of 117 species are found in Costa Rica.

This well-defined subtribe with conduplicate leaves is easily distinguished from closely related Lycastinae Schltr. By the plicate leaves of the latter. One of the most interesting aspects of the Maxillariinae is the variety of growth patterns summarized above, especially those that are sympodial as juveniles, with each abbreviated shoot terminated by a pseudobulb, but monopodial as adults, producing extensive canes lacking pseudobulbs altogether. Perhaps the pseudobulb serves to buffer water stress in small plants, which often live in usually wet but extremely windy habitats. The genus Maxillaria is here accepted in the traditional broad sense, including segregates Camaridium Lindl., Ornithidium R. Br., Pseudomaxillaria Brieger, and Sepalosaccus Schltr. We acknowledge that data from DNA studies currently being generated and analyzed cladistically should help define useful genera within the Maxillariinae.

Key to the Genera of Subtribe Maxillariinae

1a.	Plai	nts with distinct, cylindric sepaline spur
1b.	Plai	nts not with cylindric sepaline spur, although sepals may be joined
	2a.	Flowers with sepals adpressed into a cup at the base with reflexed apices, petals barely or no
		exerted beyond the reflexed part of the sepal apices giving the flower a trigonous appearance
		Trigonidiun
	2b.	Flowers not as above
		3a. Column lacking a distinct foot, i.e., the base of the column not extended below the ovary

	scape wiry, the internodes well exposed between scape bracts (Costa Rican), pedicel longer
	than the ovary Mormolyca (ringens)
3b.	Column with a distinct foot extended below the ovary, scapes with internodes entirely or
	nearly concealed by bracts, pedicel absent or if present much shorter than ovary
	Maxillaria

Cryptocentrum Benth. & Hook.

(G. Carnevali)

REFERENCES—R. L. Dressler, The systematic position of *Cryptocentrum* (Orchidaceae). Brittonia 13:266–270. 1961. G. Carnevali, Systematics, phylogeny, and twig epiphytism in *Cryptocentrum* (Orchidaceae). Ph.D. diss., University of Missouri, St. Louis. 1996.

Herb, epiphytic, rarely subterrestrial or lithophytic, monopodial or less commonly sympodial, if sympodial then stems pseudobulbous-thickened. Roots originating from the lower portions of the stems, frequently decurrent on and totally hiding the stems. Leaves distichous or polystichously arranged, conduplicate, coriaceous or succulent, flat or hemicylindric or 3-edged in cross section, articulate, glabrous, margins ciliate or erose; leaf sheaths usually wider than the blades, imbricate, conspicuously nerved. Inflorescences I-flowered, usually originating from the axils of the lowermost leaf sheaths; ovary with pedicel 6-edged, subterete, smooth, rarely winged. Flowers resupinate, nocturnally fragrant, greenish or yellowish, often with purplish suffusion. Sepals basally connate into a tube, free and somewhat divergent above; tube obconic, often fleshy-thickened; lateral sepals often longer than dorsal, basally produced into a backwardly oriented sepaline spur; sepaline spur cylindric, apically acute or somewhat saccate. Petals free, basally enclosed by the sepaline tube, the free portion usually lanceolate or oblong, erect, spreading to somewhat reflexed and then called the bent portion; bent portion frequently somewhat tailed, commonly triangular or triangular-lanceolate, fleshier than the basal portion. Lip basally produced into a backwardly oriented spur contained within the sepaline spur, the walls of the labellar spur fused with the roof of the sepaline spur; the lip blade without callus, elliptic or ovate when flattened, divided into a deeply concave or saccate hypochile contained in the sepaline tube and an erect, spreading, or reflexed, somewhat concave epichile. Column erect, stout, with 2 wings abaxially; anther terminal, pollinia 4 in 2 superposed pairs, waxy, supported on a stipe and viscidium. Fruit a capsule, oblongoid or ellipsoid, beakless.

A Neotropical genus of 17 species ranging from the Cordillera de Tilarán in northern Costa Rica to the Amazonian slopes of the Andes in Bolivia with two disjunct species in the Guayana region.

A genus well-defined by several apomorphies, *Cryptocentrum* is closely related to *Anthosiphon* (G. Carnevali, unpubl. diss.) and appears to have evolved from that genus by elongation of the sepaline spur and proportional reduction of the sepaline cup.

Key to the Species of Cryptocentrum

1a.	Leaves spiraled (polystichous) on the stem, subterete, < 3 cm long; inflorescence longer than to subequaling the subtending leaves; floral bract conspicuously shorter than the spur, only enclosing the apical ½ or less of it
	2a. Spur 12–14.5 mm long, inflorescence subequaling or little longer than subtending leaves; mono-
	podia shorter than leaves on mature plants; leaves (30)40-60(70) mm long, 0.5-1.5 mm thick
	when fresh; leaf sheaths not or inconspicously attenuated apically, not becoming clawed; lateral
	sepals always 3-nerved
	2b. Spur (15)16–19 mm long; inflorescence always conspicuously longer than subtending leaves;
	monopodia longer than leaves on mature plants; leaves (10)15-25(30) mm long, 0.3-0.5 mm
	thick when fresh; leaf sheath apically conspicuously attenuated and becoming clawed; lateral sepals usually 5-nerved, only rarely 3-nerved
1b.	Leaves distichous on the stem, subterete or flat, usually ≥ 4 cm long; inflorescence shorter or rarely
	subequaling the subtending leaves; floral bract longer than the spur, enclosing at least ¾ of its length
	3
	3a. Leaves terete or hemiterete. 1–2(3) mm wide and thick

2

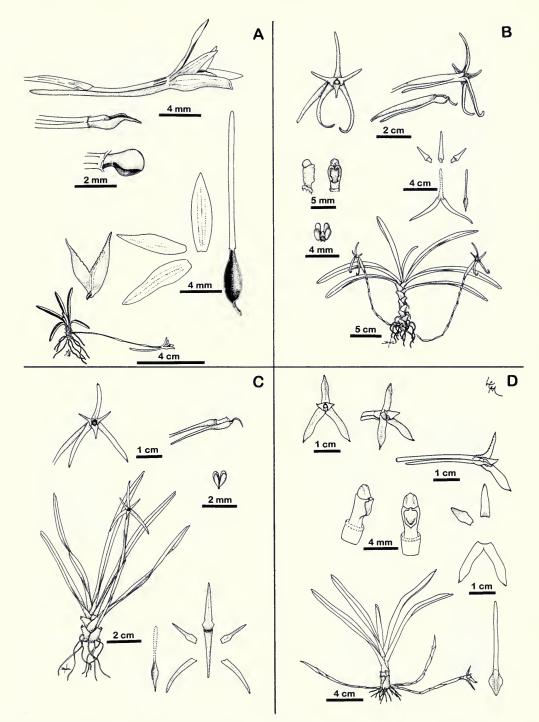


Fig. 1. **A,** *Cryptocentrum standleyi* (Icon. Pl. Trop. 14: t. 1309. Illustrator: S. Dalström). **B,** *C. latifolium* (Icon. Pl. Trop. 14: t. 1308. Illustrator: B. N. Culbertson). **C,** *C. calcaratum* (Icon. Pl. Trop. 14: t. 1307. Illustrator: B. N. Culbertson). **D,** *C. lehmannii* (Icon. Pl. Trop. 1: t. 33. Illustrator: B. N. Culbertson).

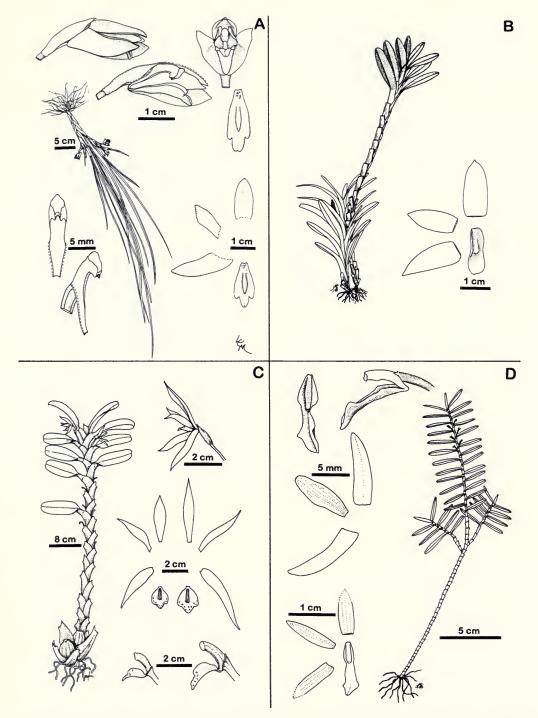


Fig. 2. **A,** *Maxillaria lueri* (Icon. Pl. Trop. 2: t. 155. Illustrator: L. Megahee). **B,** *M. alfaroi* (illustrator: S. Dalström). **C,** *M. inaudita* (Icon. Pl. Trop. 14: t. 1349. Illustrator: B. N. Culbertson). **D,** *M. valerioi* (illustrator: S. Dalström).

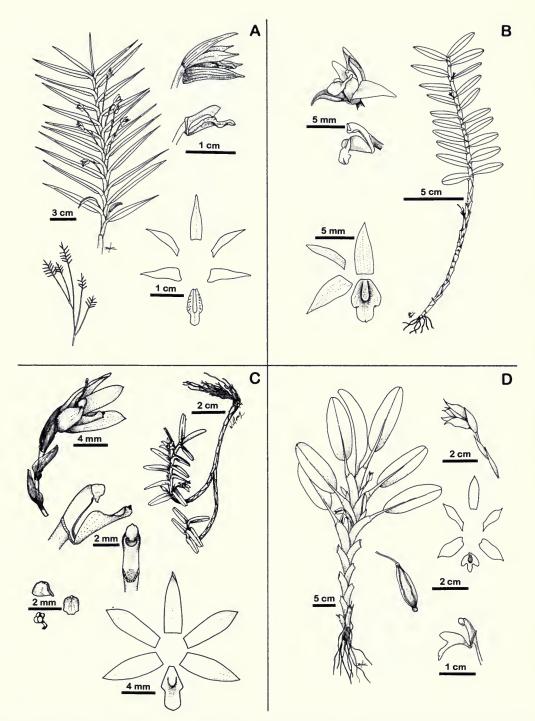


Fig. 3. **A,** *Maxillaria linearifolia* (Icon. Pl. Trop. 14: t. 1350. Illustrator: B. N. Culbertson). **B,** *M. appendiculoides* (illustrator: S. Dalström). **C,** *M. dendrobioides* (illustrator: W. Zuchowsky). **D,** *M. trilobata* (Icon. Pl. Trop. 14: t. 1367. Illustrator: B. N. Culbertson).

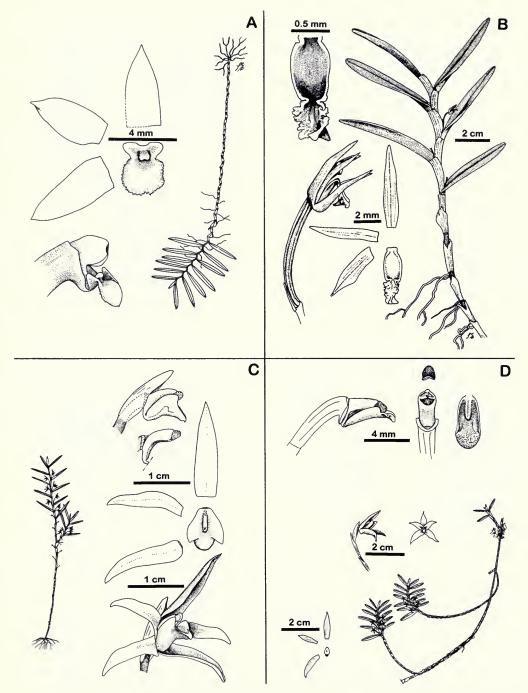


Fig. 4. A, Maxillaria adendrobium (illustrator: S. Dalström). B, M. nicaraguensis (Icon. Pl. Trop. 14: t. 1355. Illustrator: S. Dalström). C, M. tonduzii (illustrator: S. Dalström). D, M. parvilabia (illustrator: S. Dalström).

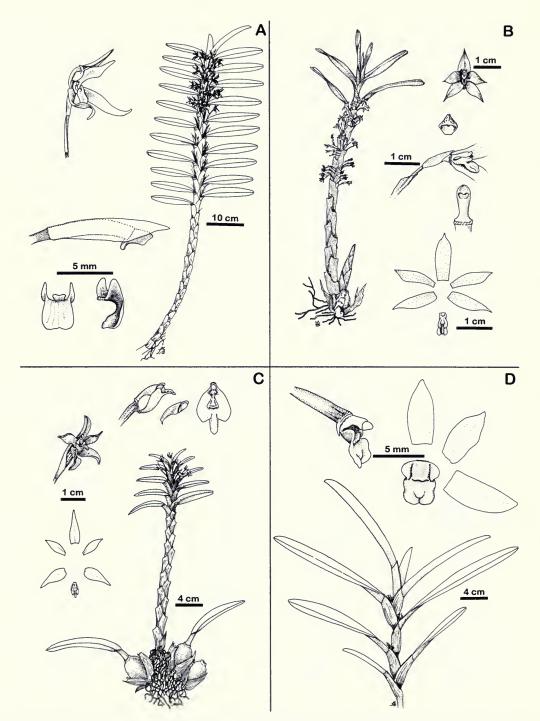


Fig. 5. **A,** *Maxillaria biolleyi* (illustrator: S. Dalström). **B,** *M. quadrata* (illustrator: L. Alfaro). **C,** *M. adolphii* (illustrator: B. N. Culbertson). **D,** *M. conduplicata* (illustrator: S. Dalström).

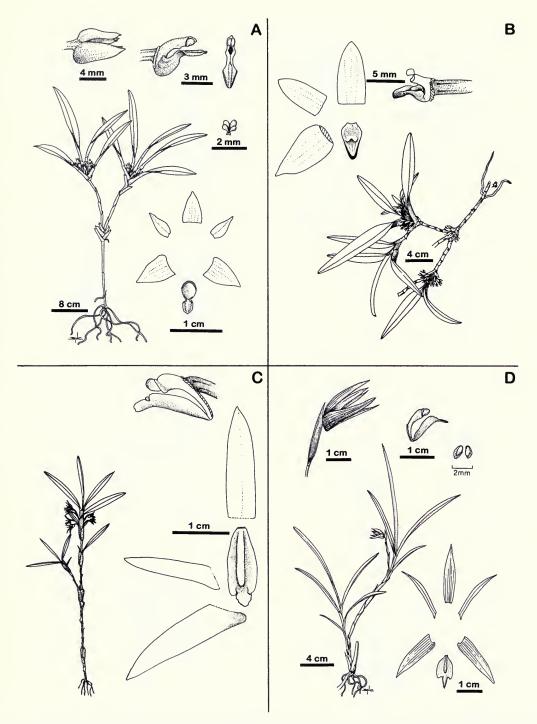


Fig. 6. A, Maxillaria fulgens (Icon. Pl. Trop. 14: t. 1348. Illustrator: B. N. Culbertson). B, M. pittieri (illustrator: S. Dalström). C, M. exaltata (illustrator: S. Dalström). D, M. meridensis (Icon. Pl. Trop. 14: t. 1352. Illustrator: B. N. Culbertson).

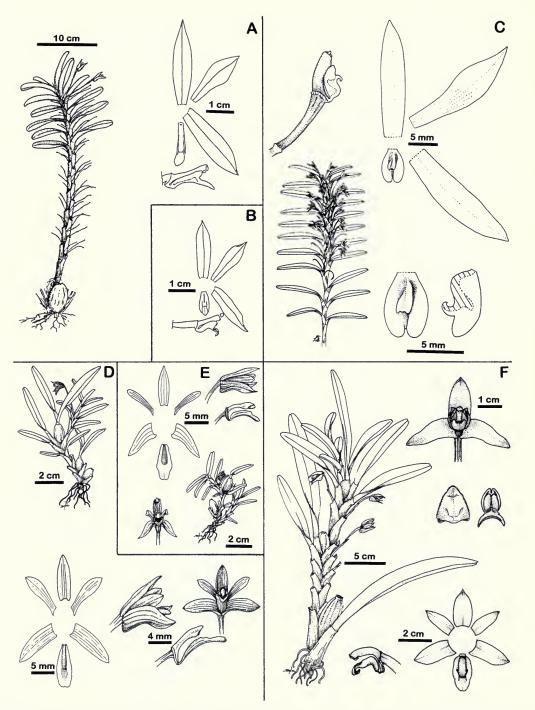


Fig. 7. **A,** *Maxillaria monteverdensis* (Lindleyana 9:241. Illustrator: G. Barboza). **B,** *M. amabilis* (Lindleyana 9:241. Illustrator: J. T. Atwood). Note: Plant habit is similar to that in Figure 7A. C, *M. falcata* (illustrator: S. Dalström). **D,** *M. acervata* (Icon. Pl. Trop. 14: t. 1346 [as synonym, *M. foliosa*]. Illustrator: B. N. Culbertson). **E,** *M. ponerantha* (Icon. Pl. Trop. 14: t. 1358. Illustrator: B. N. Culbertson). **F,** *M. elatior* (illustrators: plant habit, B. N. Culbertson; floral diagnosis, L. Alfaro).

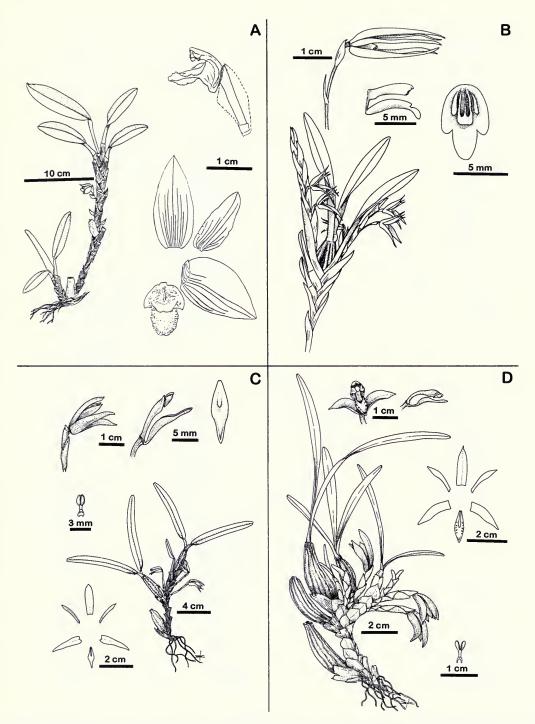


Fig. 8. A, *Maxillaria tubercularis* (Lindleyana 9:229. Illustrator: G. Barboza). B, *M. ctenostachya* (illustrator: S. Dalström). C, *M. friedrichsthalii* (Icon. Pl. Trop. 14: t. 1347. Illustrator: B. N. Culbertson). D, *M. scorpioidea* (Icon. Pl. Trop. 14: t. 1363. Illustrator: B. N. Culbertson).

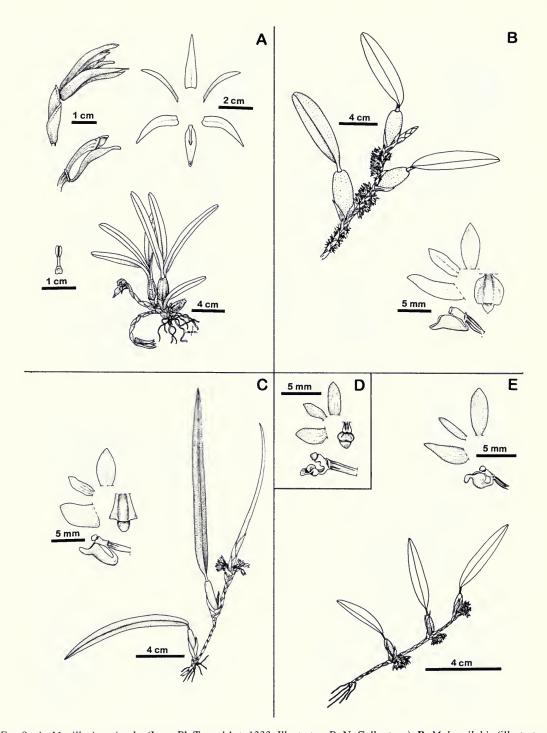


Fig. 9. A, *Maxillaria aciantha* (Icon. Pl. Trop. 14: t. 1333. Illustrator: B. N. Culbertson). **B,** *M. brevilabia* (illustrator: S. Dalström). **C,** *M. neglecta* (illustrators: plant habit, S. Dalström; floral diagnosis, Lindleyana 8:27, S. Dalström). **D,** *M. parviflora* (Lindleyana 8:27. Illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 9E. **E,** *M. concavilabia* (illustrators: plant habit, S. Dalström; floral diagnosis, Lindleyana 8:27, S. Dalström).

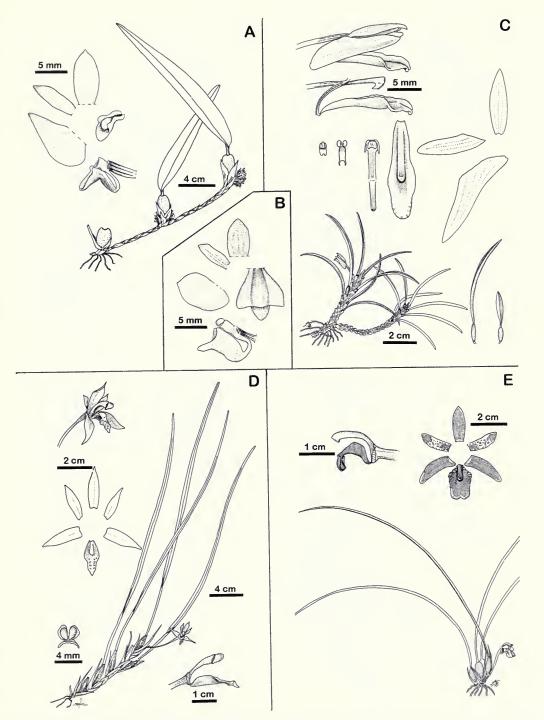


Fig. 10. A, Maxillaria horichii (illustrators: plant habit, S. Dalström; floral diagnosis, Lindleyana 8:27, S. Dalström). B, M. pseudoneglecta (Lindleyana 8:27. Illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 10A. C, M. uncata (Icon. Pl. Trop. 14: t. 1369. Illustrator: S. Dalström). D, M. tenuifolia (Icon. Pl. Trop. 14: t. 1366. Illustrator: B. N. Culbertson). Note: Lip from rehydrated flower, somewhat straightened. E, M. sanguinea (illustrators: plant habit, Icon. Pl. Trop. 14: t. 1362, S. Dalström; floral diagnosis, Icon. Pl. Trop. 15: t. 1362a, L. Alfaro).

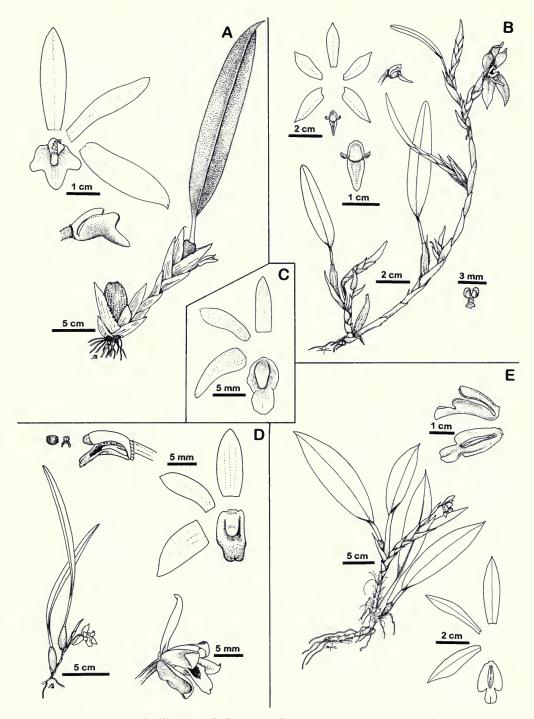


Fig. 11. A, Maxillaria planicola (illustrator: S. Dalström). B, M. tigrina (Icon. Pl. Trop. 14: t. 1306 [as synonym, Chrysocycnis tigrinum]. Illustrator: B. N. Culbertson). C, M. variabilis (illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 11D. D, M. costaricensis (illustrator: S. Dalström). E, M. haberi (Selbyana 16:244. Illustrator: B. N. Culbertson).

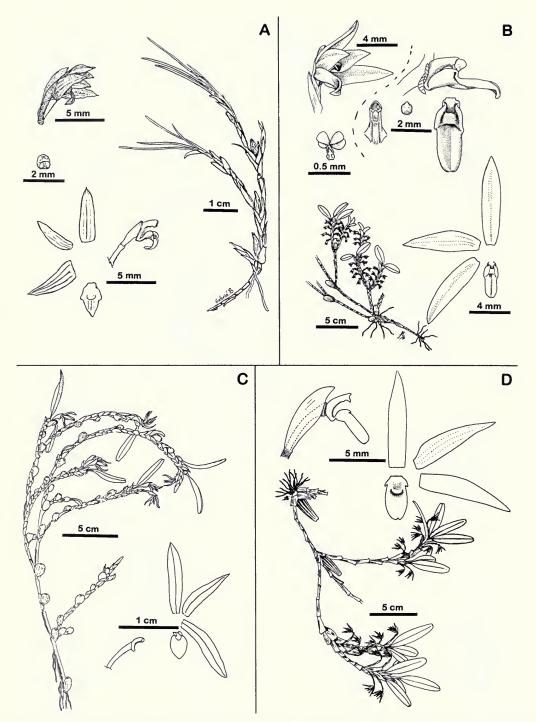


Fig. 12. **A,** *Maxillaria muscoides* (Lindleyana 9:235. Illustrator: G. Barboza). **B,** *M. microphyton* (illustrator: S. Dalström). **C,** *M. burgeri* (Lindleyana 9:234. Illustrator: G. Barboza). **D,** *M. flava* (illustrator: S. Dalström).

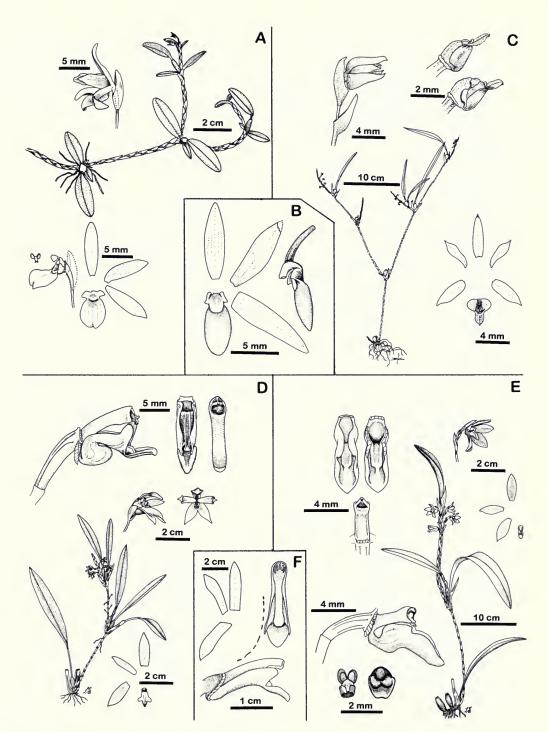


Fig. 13. A, Maxillaria wercklei (illustrator: S. Dalström). B, M. lankesteri (illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 13A. C, M. minor (Icon. Pl. Trop. t. 14: 1353. Illustrator: B. N. Culbertson). D, M. sigmoidea (illustrator: S. Dalström). E, M. paleata (illustrator: S. Dalström). F, M. vaginalis (illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 13D.

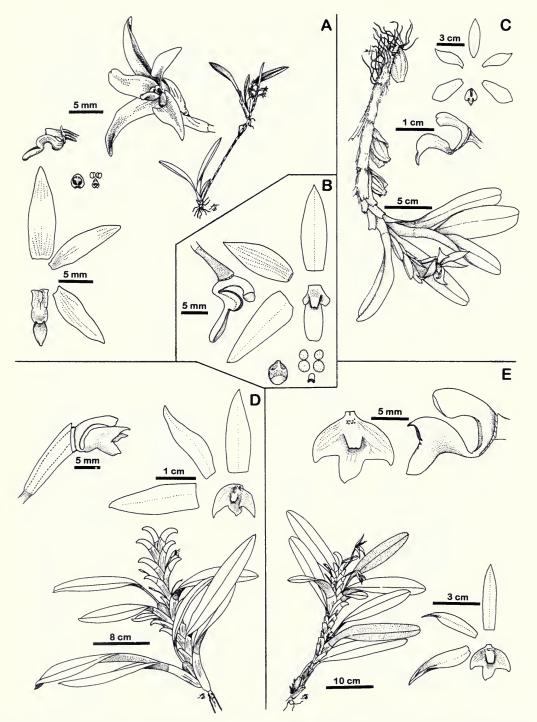


Fig. 14. A, Maxillaria schlechteriana (Lindleyana 9:230. Illustrator: S. Dalström). B, M. dichotoma (illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 14A. C, M. suaveolens (Icon. Pl. Trop. 14: t. 1365. Illustrator: B. N. Culbertson). D, M. bradeorum (illustrator: S. Dalström). E, M. ampliflora (illustrator: S. Dalström).

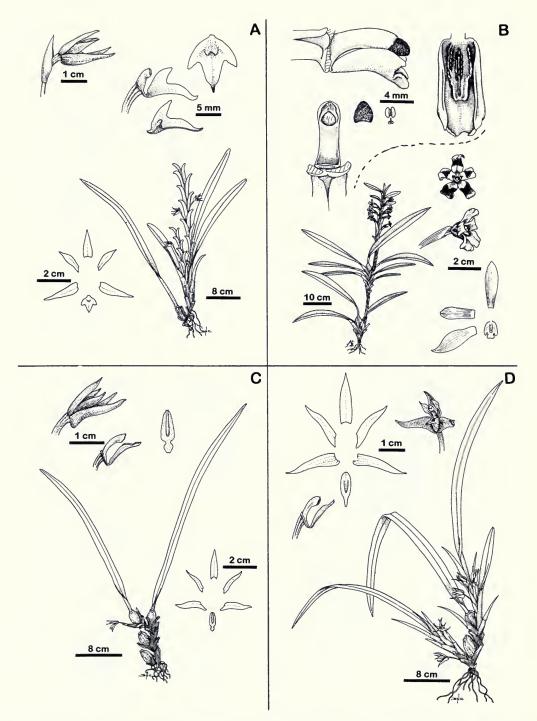


Fig. 15. **A,** *Maxillaria umbratilis* (Icon. Pl. Trop. 14: t. 1368. Illustrator: B. N. Culbertson). **B,** *M. campanulata* (illustrator: S. Dalström). **C,** *M. oreocharis* (Icon. Pl. Trop. 14: t. 1356. Illustrator: B. N. Culbertson). **D,** *M. alba* (Icon. Pl. Trop. 14: t. 1334. Illustrator: B. N. Culbertson).

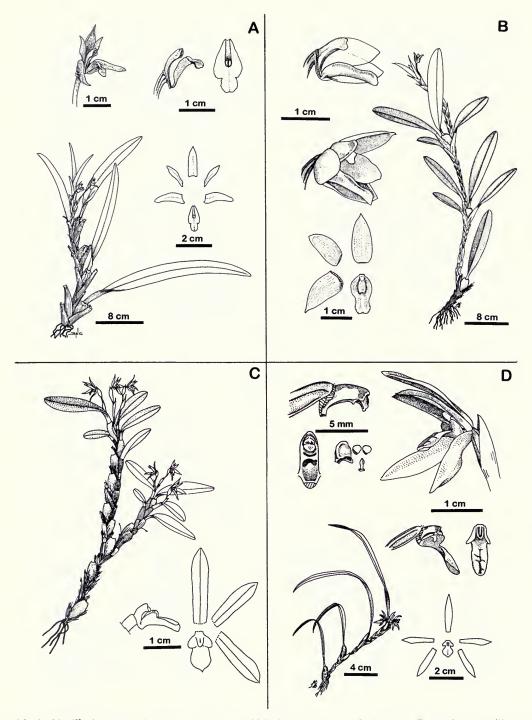


Fig. 16. **A,** *Maxillaria anceps* (Icon. Pl. Trop. 14: t. 1335. Illustrator: B. N. Culbertson). **B,** *M. diuturna* (illustrator: S. Dalström). **C,** *M. bracteata* (illustrators: plant habit, S. Dalström; floral diagnosis, Lindleyana 9:240, J. T. Atwood). **D,** *M. gomeziana* (illustrator: S. Dalström).

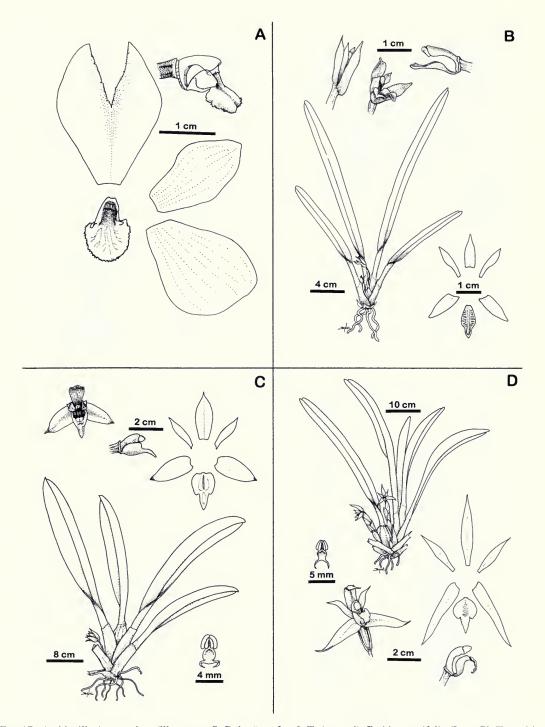


Fig. 17. A, Maxillaria serrulata (illustrator: S. Dalström after J. T. Atwood). B, M. crassifolia (Icon. Pl. Trop. 14: t. 1341. Illustrator: B. N. Culbertson). C, M. maleolens (Icon. Pl. Trop. 14: t. 1351. Illustrator: B. N. Culbertson). D, M. nasuta (Icon. Pl. Trop. 14. t. 1354. Illustrator: B. N. Culbertson).

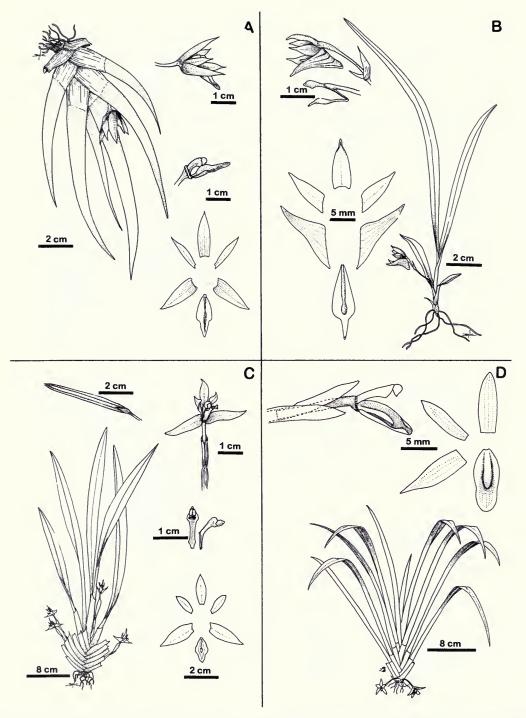


Fig. 18. **A,** *Maxillaria valenzuelana* (Icon. Pl. Trop. 14: t. 1370. Illustrator: B. N. Culbertson). **B,** *M. angustissima* (Icon. Pl. Trop. 14: t. 1337. Illustrator: B. N. Culbertson). **C,** *M. chartacifolia* (Icon. Pl. Trop. 14: t. 1340. Illustrator: B. N. Culbertson). **D,** *M. bicallosa* (illustrator: S. Dalström).

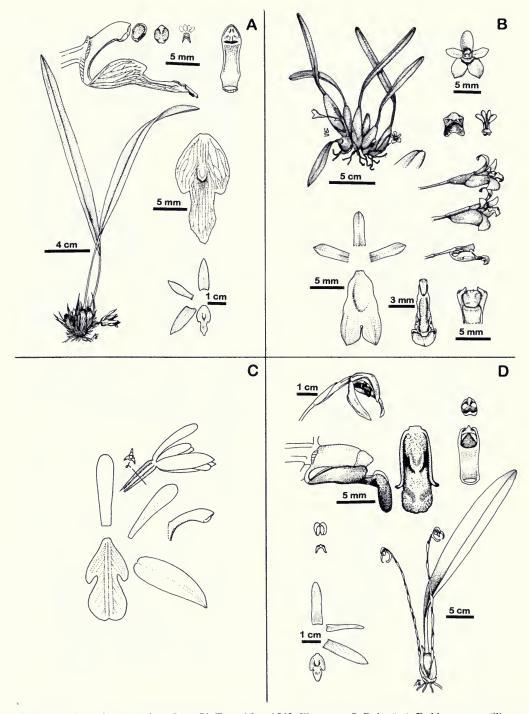


Fig. 19. **A,** *Maxillaria longipetiolata* (Icon. Pl. Trop. 16: t. 1563. Illustrator: S. Dalström). **B,** *M. strumata* (illustrator: L. Alfaro). **C,** *M. piestopus* (illustrator: S. Dalström after J. T. Atwood). **D,** *M. longiloba* (Icon. Pl. Trop. 16: t. 1562. Illustrator: S. Dalström).

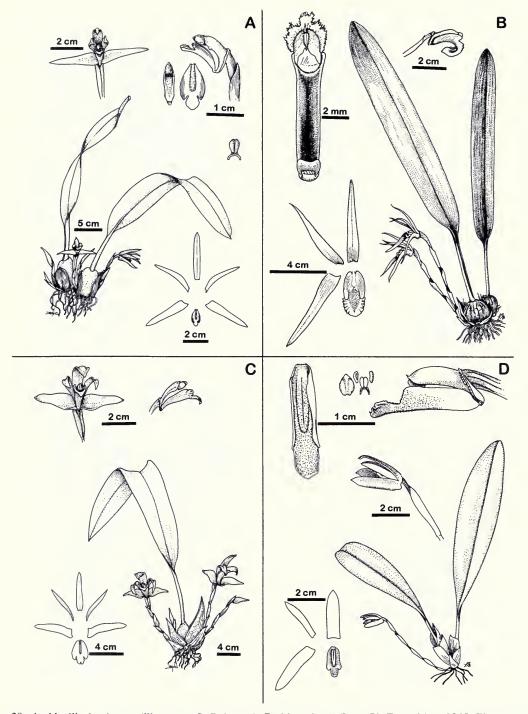


Fig. 20. **A,** *Maxillaria ringens* (illustrator: S. Dalström). **B,** *M. endresii* (Icon. Pl. Trop. 14: t. 1345. Illustrator: S. Dalström). **C,** *M. angustisegmenta* (Icon. Pl. Trop. 14: t. 1336. Illustrator: B. N. Culbertson). **D,** *M. cryptobulbon* (illustrator: S. Dalström).

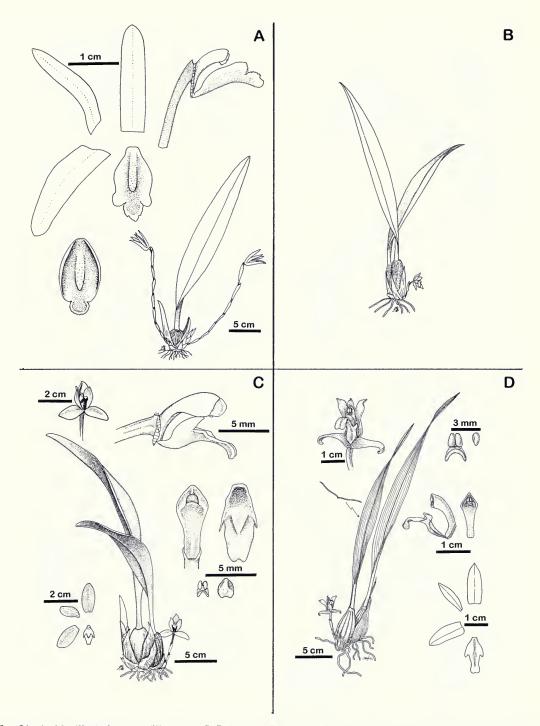


Fig. 21. **A,** *Maxillaria brunnea* (illustrator: S. Dalström). **B,** *M. acutifolia* (illustrator: S. Dalström). **C,** *M. hedwigiae* (illustrator: S. Dalström). **D,** *M. dressleriana* (illustrator: B. N. Culbertson).

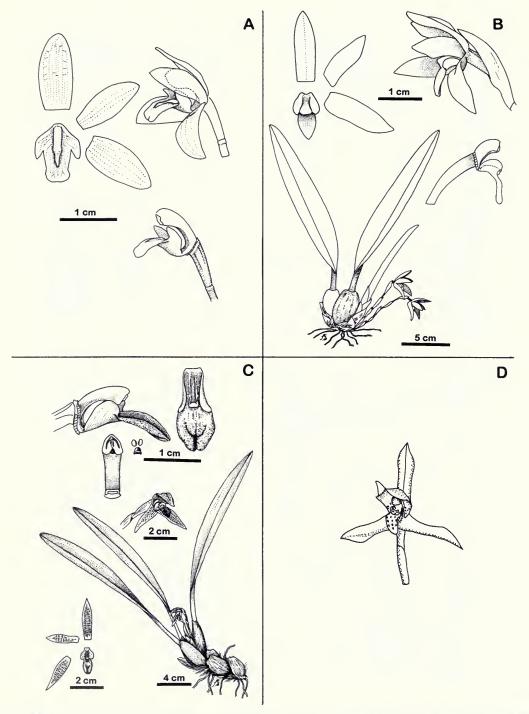


Fig. 22. **A,** *Maxillaria moralesii* (Lindleyana 11:31. 1996. Illustrator: B. N. Culbertson). **B,** *M. obscura* (illustrator: S. Dalström). **C,** *M. punctostriata* (illustrator: S. Dalström). **D,** *M. cedralensis* (illustrator: J. T. Atwood).

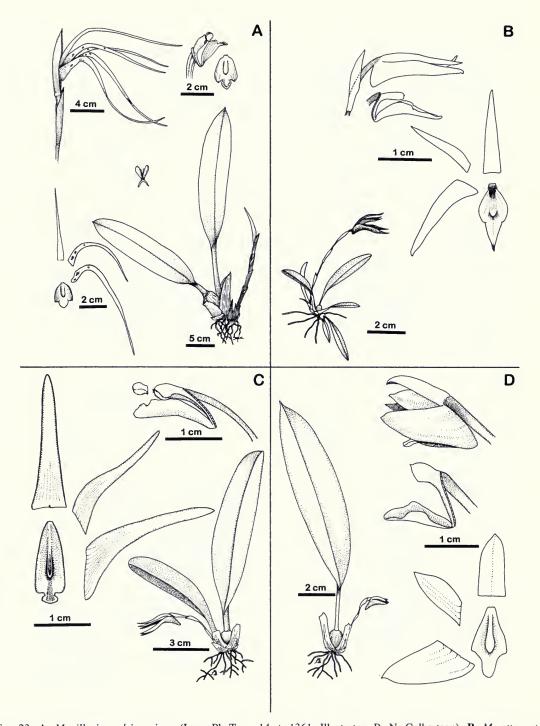


Fig. 23. **A,** *Maxillaria rodrigueziana* (Icon. Pl. Trop. 14: t. 1361. Illustrator: B. N. Culbertson). **B,** *M. attenuata* (illustrator: S. Dalström). **C,** *M. confusa* (illustrator: S. Dalström). **D,** *M. ramonensis* (illustrator: S. Dalström).

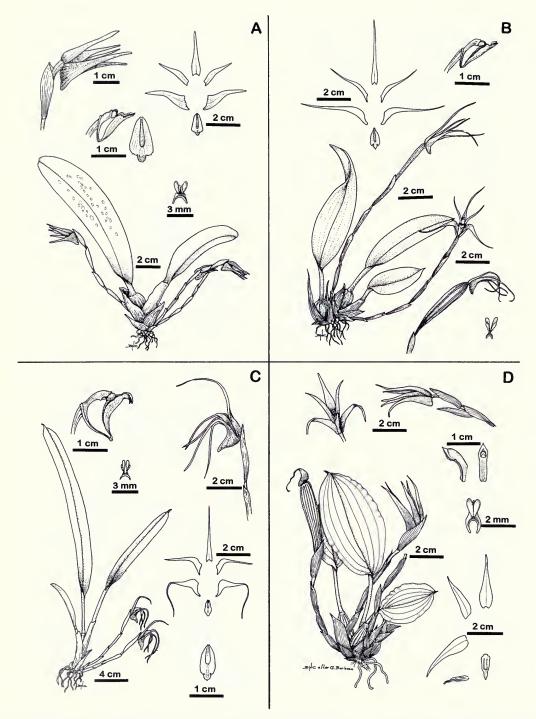


Fig. 24. A, Maxillaria reichenheimiana (Icon. Pl. Trop. 14: t. 1359. Illustrator: B. N. Culbertson). B, M. pachyacron (Icon. Pl. Trop. 14: t. 1357. Illustrator: B. N. Culbertson). C, M. arachnitiflora (Icon. Pl. Trop. 14: t. 1338. Illustrator: B. N. Culbertson). D, M. chionantha (Selbyana 16:242. Illustrator: B. N. Culbertson after G. Barboza).

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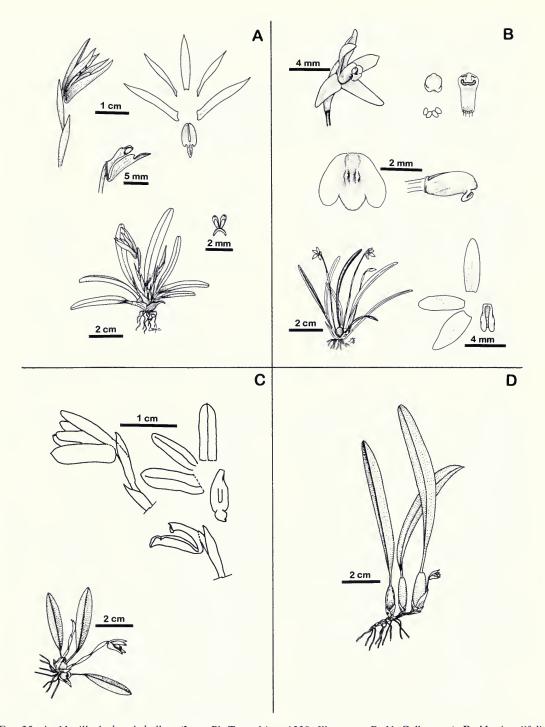


Fig. 25. **A,** *Maxillaria brachybulbon* (Icon. Pl. Trop. 14: t. 1339. Illustrator: B. N. Culbertson). **B,** *M. vittariifolia* (Icon. Pl. Trop. 14: t. 1372. Illustrator: S. Dalström). **C,** *M. acostae* (illustrators: plant habit, S. Dalström; floral diagnosis, J. T. Atwood). **D,** *M. caespitifica* (illustrator: S. Dalström, based on a Nicaraguan collection [*Atwood 6978*]).

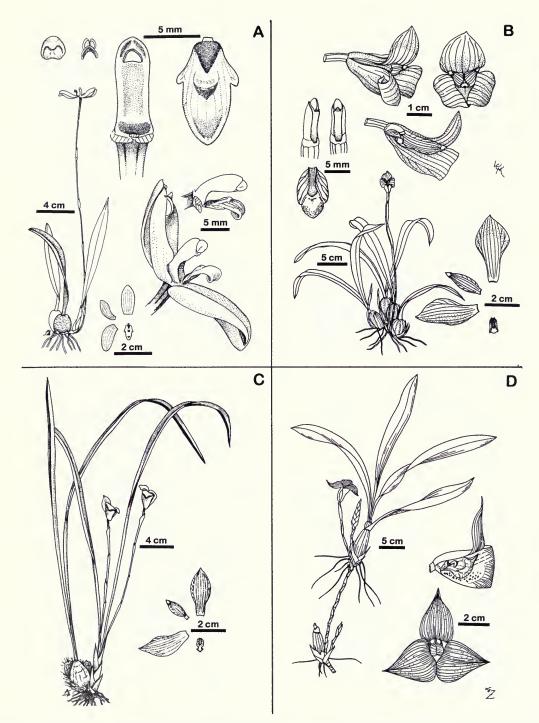


Fig. 26. **A,** *Mormolyca ringens* (illustrator: S. Dalström). **B,** *Trigonidium egertonianum* (Icon. Pl. Trop. 4: t. 345. Illustrator: L. Megahee). **C,** *T. riopalenquense* (Icon. Pl. Trop. 14: t. 1399. Illustrator: S. Dalström). **D,** *T. lankesteri* (Icon. Pl. Trop. 4: t. 346. Illustrator: W. B. Zomlefer, based on an Ecuadorian plant probably misdetermined as *T. insigne* Rchb. f. ex Benth. & Hook.).

28

- 4a. Leaves (8)10–16(20) mm wide, leaf apex with longer lobe exceeding the shorter by (2)3–
- mm 5
 - 5a. Inflorescence with 3-4(5) internodes, the floral bract comprising \(\frac{1}{2} \frac{1}{2} \) of total inflorescence length; bracts of the inflorescence somewhat inflated; perianth segments clear green or yellow-green, usually not tinged with other colors C. calcaratum
 - 5b. Inflorescence with (5)6–11 internodes, the floral bract comprising $\frac{1}{10}$ – $\frac{1}{10}$ of total inflorescence length; inflorescence bracts all tubulose; flowers dull green tinged with

Cryptocentrum calcaratum (Schltr.) Schltr., Orchideen 449. 1914. Pittierella calcarata Schltr., Repert. Spec. Nov. Regni Veg. 3:80-81. 1907. TYPE: Costa Rica, Province of Alajuela, La Palma, A. Tonduz 9682 (holotype: B, destroyed; drawing at AMES). Figure 1C.

Epiphytic herb (5)8–20(28) cm tall, monopodial, rarely branching from the base; stems (1)2–7(10) cm long, usually erect, distichously 4-8-leaved at the apical ½, basal ½ covered with defibrating leaf sheaths and decurrent roots that give it a pseudobulbous appearance. Leaves coriaceous, flat or somewhat convex or concave, straight or arcuate, midnerve shallowly sulcate on ventral surface, slightly keeled on dorsal surface especially toward apex, (4)5-15(20) cm long, (4)6-11(12) mm wide; sheath 1-2 cm wide; blades oblong-elliptic to narrowly oblong-elliptic, apex obtuse to subacute, asymmetrically 2-lobulate; margins and keel erose. Inflorescence (2)3-6 cm long, much shorter than the leaves, 1-3(5) appearing simultaneously from the rooting zone, erect, sheathed with inflated and dorsally sharply keeled bracts; ovary with pedicel smooth or somewhat verruculose, (26)30-36(38) mm long, subterete, straight, subtended by a subequal floral bract. Flowers spreading, greenish or yellowish green, the segments rarely suffused with purple or brownish apically. Sepals subfleshy, flat or with margins slightly involute, obtuse to rarely acute; dorsal narrowly triangular, narrowly oblong-elliptic to narrowly elliptic, 9-15 mm long, (3.5)4-5(6) mm wide; lateral sepals narrowly lanceolate to narrowly elliptic-lanceolate, 12-16 mm long, 3.5-5 mm wide; tube 4-5 mm long, 2.5-3 mm thick, fusiform to broadly fusiform-obconic; sepaline spur 22-32 mm long, cylindric, straight. Petals narrowly trullate to trullate-elliptic, (9)10-15(17) mm long, 2.5-4 mm wide, the basal section contained in the sepaline tube, concave; bent portion 5-11 mm long starting ca. 2 mm above the mouth of the sepaline tube, 2.5-3.5 mm wide at base, apex obtuse to subacute, margins flat or somewhat revolute. Lip laxly covered with long white or greenish hairs in some clones, sigmoid in profile, 6-9 mm long, 4.5-5 mm wide when spread; hypochile broadly elliptic to suborbicular when expanded, 4-5 mm long, 2-3 mm deep; epichile fleshier than hypochile, conduplicate-concave, lanceolate to lanceolate-triangular, 3-4 mm long, 1.5-2 mm wide, obtuse to subacute. Column stout, 2.5-3.5 mm long, flanked by dolabriform wings for 3/3 of its length, anterior margins of the wings projected forward; anther ca. 2 mm long, ventrally with a pair of retrorse teeth; pollinia 4, ellipsoid. Capsule ellipsoid or oblongoid, 2.5–3.2 cm long.

Apparently restricted to open places at the forest edges or high on trees within cloud forests at 1000-2400 m. Flowering mostly July to October. Costa Rica and adjacent Panama. Frequent on pasture trees at the Monteverde Reserve in the Cordillera de Tilarán but rather rare in southeastern Costa Rica and Panama.

Cryptocentrum flavum Schltr., Repert. Spec. Nov. Regni Veg. 12:214. 1913. TYPE: Colombia, Cauca, Córdoba, Dagua Valley, Pacific coastal zone, 30-100 m, H. Pittier 591 (holotype: US).

Plant an epiphytic herb, erect or ascendent, monopodial, often branching with age, 4-8 cm tall. Stem basally enveloped by decurrent roots, leaf arrangement polystichous. Leaves straight or slightly recurved, usually speckled with dull red-maroon, linear or linear-oblong, hemicylindric or subtriquetrous in cross section, obscurely keeled beneath, (30)40–60(70) mm long, 1.5– 2.5 mm wide; apex obtuse to acutely obtuse, microscopically mucronulate; margins and keel microscopically erose. Inflorescence erect, spreading, or descending, subequaling or slightly longer than the subtending leaves, 1-2(4) appearing simultaneously from the lower stem, (1.5)3-6(7) cm long, bracts much shorter than the internodes, tubulose; ovary with pedicel green tinged with red-maroon, subterete, (8)10-14.5(16) mm long, subtended by a floral bract 5-7 mm long and enclosing only the apical 1/10-1/5 of the spur. Flowers greenish or dull ocher-yellow, often tinged with dull red-maroon toward the bases of the perianth segments, subcampanulate or with perianth segments spreading to an angle of 45-80°. Sepals somewhat fleshy, convex, often with recurved margins; dorsal narrowly lanceolate to lanceolate or oblong-lanceolate, 5-7 mm long, 1.3-2.1 mm wide, obtuse to obtusely acute; lateral sepals narrowly lanceolate to lanceolate, 5-6 mm long, 1.3-2 mm wide, obtuse or acute; tube broadly obconic, broadly 3-keeled, 1–1.5 mm thick; sepaline spur cylindric, broadly and obscurely clavate, straight, rarely somewhat curved, 12-14.5 mm long. Petals narrowly lanceolate to lanceolate, 6–8.5 mm long, 1.5-2 mm wide; basal section shallowly concave and projecting well beyond the sepaline cup for 1.5-2 mm; bent portion fleshier than the basal portion, bending angle 35-45°, 3-5 mm long, 1-1.3 mm wide at base, apex acute and acuminate. Lip sigmoid in profile,

6–7.5 mm long, 2.5–2.7 mm wide when spread; hypochile shallowly saccate, elliptic when expanded, 4 mm long, 1–1.2 mm deep; epichile straight or slightly downflexed, bending angle 0–45°, narrowly triangular to triangular-lanceolate, 3.2–4 mm long, 1.5–1.8 mm wide at base, acuminate. Column dorsally flat or convex, ventrally flanked by dolabriform wings for ¼–½ its length, 2.4–2.6 mm long, 1.3–1.5 mm thick; anther ca. 1 mm long and tall, ventrally with an obscure pair of teeth, 0.2–0.3 mm long. Capsule 1.5–2 cm long.

Epiphytic in tropical wet to cloud forests at 0–1650 m. Flowering in Costa Rica little known; elsewhere apparently throughout the year. Extreme southeastern Costa Rica to Ecuador.

Cryptocentrum flavum and closely related C. standleyi are easily recognized by the small stature of the plants but are difficult to distinguish from each other, especially in dried specimens. Plants of C. flavum usually have longer leaves that are also thicker, straighter, and stiffer. The stems of C. flavum are always shorter than those of C. standleyi for an equivalent number of internodes. The spur of C. flavum is 12–15 mm long but rarely as short in C. standleyi.

Cryptocentrum gracillimum Ames & C. Schweinf., Sched. Orch. 8:68. 1925. TYPE: Costa Rica, Cartago, Pejivalle, 2300 ft, 16 May 1924, *Lankester 866* (holotype: AMES).

Plant an epiphytic herb, erect, 7-15 cm tall, monopodial but older plants producing 1-many lateral offsets and then plants densely cespitose. Stems enveloped by decurrent roots basally, apically by leaf sheaths. Leaves hemicylindric, linear, (4)5.5-10(15) cm long, 2-2.5 mm thick, adaxially shallowly concave, abaxially convex with no raised midvein; apex obtuse (acute in dried specimens), unequally 2-lobate; margins erose; sheaths 5–12 mm long, ca. 5 mm wide, multinerved. Inflorescences appearing simultaneously from the rooting zone, erect or horizontally spreading, 4-9 cm long; peduncle terete but the last internode obscurely compressed, sheathed with conduplicate dorsally keeled bracts; ovary with pedicel 17-21 mm long, laxly covered with microscopic glandular hairs, subtended by a floral bract 19-24 mm long, spathaceous and inflated, open only at the apex, enclosing the spur and covering the floral tube partially or totally. Flowers with widely spreading segments, pale greenish yellow, green, dull olivaceous, or dull tanbrown. Sepals subfleshy, oblong-elliptic, obtuse, margins revolute; dorsal 8-10 mm long, 2.5-3.1 mm wide; laterals 8-10 mm long, 2.3-2.8 mm wide; sepaline cup fusiform-obconic, 2-3 mm long, 1.9-2.5 mm thick; sepaline spur cylindric, only obscurely clavate, 13.5-19 mm long. Petals narrowly lanceolate, acute, long acuminate, 8.3-10 mm long, 1.9-2.1 mm wide; bent portion 4-5 mm long, starting well above the mouth of the sepaline cup, bending angle 45-90°. Lip sigmoid in profile, 7-8 mm long, 2.8-3.2 mm wide when expanded, throat with a few white hairs; hypochile broadly elliptic

to ovate, with 3 thick nerves and 2 thinner outer ones, margins straight; epichile narrowly lanceolate, 3-nerved, down-flexed, bending angle 45–90°, 4–5 mm long. Column arcuate, 2.1–3 mm long, ca. 1.5 mm thick, flanked by dolabriform wings for 3/3 its length; anther 1–1.2 mm long, 1.2–1.5 mm tall, ventrally with a pair of retrorse teeth; pollinia ellipsoid, dull cream-yellow.

A rare epiphyte within its range growing in either bright or shady conditions at 500–1000 m. Flowering May to December. Endemic to the Central Valley of Costa Rica; replaced in Panama by an undescribed species.

The hemiterete leaves on an abbreviated distichous-leaved stem are good field characters for recognition.

Cryptocentrum latifolium Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:247. 1923. TYPE: Costa Rica, Alajuela, Las Angeles de San Ramon, A. Brenes 56 (holotype: B, destroyed; lectotype: drawing at AMES). Figure 1B.

Plant an epiphytic herb, occasionally growing on road banks or rocks, monopodial, erect or horizontally spreading, rarely producing basal offshoots, (7)12–20(30) cm tall. Stems covered basally by decurrent roots, apically by leaf sheaths. Leaves distichous, conduplicate, fleshy-coriaceous, linear-oblong to narrowly oblong-obovate, erect to arcuate, flat to adaxially convex, 5-20(30) cm long, (8)10-16(20) mm wide; apex obtuse to subrounded, strongly unequally 2-lobate, obscurely keeled, margins erose, especially toward apex. **Inflorescences** to as long as the leaves, usually shorter, (4)6-13(20) cm long, appearing simultaneously from the rooting zone, erect or horizontally spreading or pendent; peduncle stout, bracts subequal to the internodes; ovary with pedicel 28-35 mm long, subterete, laxly to subdensely covered with glandular hairs; subtended by a floral bract 30-42 mm long, somewhat inflated, totally enclosing the ovary and spur and occasionally the base of the dorsal sepal. Flowers among the largest in the genus with widely spreading perianth segments, greenish brown or yellow-green, often heavily tinged with maroon, or totally maroon. Sepals fleshy, obtuse to acute, subapically mucronulate to conspicuously mucronate, margins revolute, especially the laterals; dorsal lanceolate to elliptic-lanceolate, 15-20 mm long, 5-8 mm wide; lateral sepals oblong to narrowly oblong-elliptic, 18-30 mm long, 3.5-5.5 mm wide; tube cylindric to broadly cylindric-obconic, 2-3 mm long; sepaline spur cylindric, not clavate or obscurely so, 26–30 mm long. **Petals** elliptic to broadly elliptic, 10–16 mm long, 4– 5.5 mm wide, the basal section included in the sepaline cup, concave; bent portion 5-7.5 mm long, 3-5.5 mm wide at the base, conspicuously fleshier than basal portion, bending angle 90–180°. Lip sigmoid in profile, 8– 12 mm long, 4.5–6 mm wide when expanded; hypochile broadly elliptic to rounded when expanded, 4.5-5.5 mm long, 2.5-3 mm deep, margins straight; epichile triangular to broadly ovate, 2.5-3.5 mm long. Column 3-4 mm long, ca. 2 mm thick, dorsally slightly arcuate,

flanked by dolabriform wings for $\frac{1}{2}$ its length; anther 1.8–2.2 mm long, ventrally with a pair of retrorse teeth. **Capsule** 30–40 mm long, ellipsoid.

Epiphytic on larger branches in very humid to moist forests at 0–1500 m. Flowering June to October. Costa Rica to Ecuador.

Cryptocentrum latifolium is the largest species in the genus and has the largest flowers, although small plants start flowering when they could be confused with other species. The broad, very unequally 2-lobate leaf apex is unique, with the longer lobe exceeding the shorter by (2)3–5(12) mm.

Cryptocentrum lehmannii (Rchb. f.) Garay, Bot. Mus. Leafl. 18:209. 1958. Aeranthus (Cryptoplectri) lehmannii Rchb. f., Otia Bot. Hamb. 10. 1878. TYPE: Ecuador, Tungurahua, Volcán Tungurahua, Baños, 7400 ft (2320 m), Mar. 1877, F. Lehmann 601 (w). Campylocentrum lehmannii (Rchb. f.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 8: 164. 1921. (sphalm). Cryptocentrum jamesonii Benth., Gen. Pl. 557. 1883. TYPE: Ecuador, Pichincha, Jameson s.n. (holotype: K). Cryptocentrum gracilipes Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:246. 1923. TYPE: Costa Rica, Alajuela, Los Angeles de San Ramón, Brenes 37 (holotype: B, destroyed). Figure 1D.

Plant an epiphytic monopodial herb (8)12-25(30) cm tall, rarely branching from the base. Stems erect, basal ½ covered with filiferous leaf sheaths and decurrent roots, distichously 5–8-leaved apically. Leaves coriaceous to somewhat fleshy, flat or somewhat convex or concave, arcuate or stiffly erect, linear to linear-elliptic, (5)10-20(25) cm long, (1.5)3-9(12) mm wide; apex obtuse to acute, unequally 2-lobate. Inflorescences rarely exceeding the leaves, 1-4(6) appearing simultaneously from the rooting zone, arcuate or horizontally spreading to erect, (4)5.5-12(15) cm long; peduncle with bracts shorter to somewhat longer than the internodes; ovary with pedicel (15)22-30 mm long, subtended by a floral bract reaching and enclosing the dorsal section of the tube. Flowers with perianth segments opening to an angle of 70-90°, dark green with dark reddish or purplish tinge. Sepals somewhat fleshy, lanceolate or oblong-lanceolate, acute to subobtuse, with margins usually revolute; dorsal 8-15(20) mm long, 3-6 mm wide; lateral sepals often somewhat oblique, (10)12-20(22) mm long, (3)4-6 mm wide; sepaline cup broadly obconic, obscurely keeled, 2-3(3.5) mm long and thick; sepaline spur cylindric to strongly clavate, straight, (10)15-27 mm long. **Petals** trullate-elliptic, (8)12–16(18) mm long, the basal section contained in the sepaline tube, concave; bent portion 5-9 mm long, margins somewhat or strongly revolute, bending angle 45-90°. Lip sigmoid in profile, 6-10(13) mm long, 4-6 mm wide when spread; hypochile broadly elliptic to almost orbicular when expanded, 4.5-6 mm long, 2.6-3 mm deep; epichile conduplicate-concave or flat, lanceolate to lanceolate-triangular, 4-7 mm long, 2-2.5 mm wide, obtuse to acute, bending angle 10-180°. Column 2.5–4 mm long, 1.5–1.8 mm thick, flanked by dolabriform wings for ¾ its length, anterior wing margins projected forward; anther 2 mm long, with a pair of retrorse teeth

Cloud forests mostly at 1200–2000 m. Flowering mostly December to July. Costa Rica to Ecuador.

In Costa Rica, *C. lehmannii* can be easily distinguished from *C. calcaratum* by the inflorescences with (5)6–12 internodes as opposed to 3–4(5) internodes in the latter species. It has smaller flowers than *C. latifolium*.

Cryptocentrum standleyi Ames, Sched. Orch. 9: 55–56. 1925. TYPE: Costa Rica, San José, La Palma, ca. 1600 m, 3 Feb. 1924, *P. C. Standley 33028* (holotype: AMES). *Cryptocentrum longiscapum* Brieger, Bot. Jahrb. Syst. 97:568. 1977. TYPE: Colombia, Coteje on Río Timbiqui, 200–500 m, *Lehmann 8961* (holotype, K). *Cryptocentrum brenesii* Schltr., nom. Figure 1A.

Plant an epiphytic herb, erect or ascendent, monopodial, branching with age, (2)4-10(20) cm tall. Stems basally enveloped by decurrent roots; apical ½ polystichous with many leaves. Leaves often recurved, linear or linear-obovate to narrowly obovate (small leaves), hemicylindric to triquetrous in cross section, obscurely keeled below especially apically, (10)15–25(30) mm long, apex obtuse, mucronulate, margins erose. Inflorescences appearing simultaneously from the lower- or midstem internodes, erect but peduncle frequently curving, with 3-4 internodes, (2.5)3.5-6(7.5) mm long; ovary with pedicel subterete, whitish or pinkish, or tinged with red-maroon, (14)18–22 mm long, subtended by a floral bract 5-9 mm long. Flowers yellow-green or yellow-orange, often heavily tinged with several shades of maroon, or entirely maroon to dull wine red, subcampanulate or with perianth segments spreading to an angle of 45-90°. Sepals subfleshy, oblong to oblong-lanceolate, subapically mucronulate, convex, often with revolute margins; dorsal 6.5-8 mm long, 1.5-2 mm wide, obtuse to obtusely acute; lateral sepals 7-10 mm long, 1.8–2 mm wide, acute; tube broadly obconic, dorsally convex, ventrally convex, broadly 3-keeled, 1-1.3 mm long, ca. 2 mm thick; sepaline spur cylindric, broadly and obscurely clavate, straight or curved, (15)16-19 mm long. Petals narrowly elliptic, 7.5–8 mm long, 2.1–2.2 mm wide; basal section concave and projecting well beyond the sepaline tube; bent portion fleshier than the basal portion, bending angle 35-45°, 3.2-4.2 mm long, 1.8-2 mm wide at base. Lip sigmoid in profile, 6-6.5 mm long, 2-2.5 mm wide when expanded; hypochile deeply saccate, when expanded broadly elliptic, 1.5–2 mm long, 1.2–1.5 mm deep; margins entire; epichile narrowly triangular-lanceolate, straight or slightly down-flexed, bending angle 0-45°, 3-4 mm long, 1.2-1.5 mm wide at base, acuminate. Column 2-2.5 mm long, 1.8-2 mm thick, ventrally flanked by dolabriform wings for 3/3 its length; anther 0.8-1 mm long and tall, ventrally with an obscure pair of teeth; pollinia irregularly ellipsoid, supported on an oblong stipe and amorphous viscidium.

Cryptocentrum standleyi grows both on twigs and on larger branches over a range of light exposures in rain and cloud forests from 200–2050 m. Sporadically continuously blooming, but mostly from June through December during the rainy season. Costa Rica to Ecuador.

This species and *C. flavum* are similarly small species but difficult to distinguish from one another. *Cryptocentrum standleyi* usually has longer inflorescences and longer spurs and has shorter and thinner leaves.

Maxillaria Ruíz & Pavón

(J. T. Atwood)

REFERENCES-J. T. Atwood, Orchids of Costa Rica 1. Icones Plantarum Tropicarum 14: plates 1301-1400. 1989. J. T. Atwood, A revision of the Maxillaria neglecta complex (Orchidaceae) in Mesoamerica. Lindleyana 8:25-31. 1993. J. T. Atwood, Two new species of Maxillaria (Orchidaceae) from southern Central America and a new name for a well-known taxon. Lindleyana 9:227-231. 1994. J. T. Atwood, Two new Costa Rican species of Maxillaria (Orchidaceae) related to Maxillaria flava and Maxillaria microphyton. Lindleyana 9:232-237. 1994. J. T. Atwood, Two new species of Costa Rican Maxillaria (Orchidaceae), and a clarification of Maxillaria bracteata. Lindleyana 9:239-242. 1994. J. T. Atwood, Two overlooked species of Maxillaria from Central America. Selbyana 16:242-245. 1995. G. Carnevali and J. T. Atwood, Orchidaceae Dunstervillorum II. Maxillaria cryptobulbon sp. nov. and a note on the Maxillaria brunnea complex. Novon 1:159-164. 1991. G. Carnevali and J. T. Atwood, Two new species in the Maxillaria rufescens complex from Central America. Lindleyana 11:27-33. 1996. K. Senghas, Subtribus: Maxillariinae. *In R. Schlechter. Die Orchideen* 29:1727–1803. 1994.

Epiphytic herb cespitose or rhizomatous, sometimes cespitose as juveniles but rhizomatous at maturity; rhizomes often aerial, with short to elongate, often branching stems, with or without apically 1-4-leaved pseudobulbs. Pseudobulbs always terminating the shoot when present, less often absent, and forming indeterminate shoots. Leaves conduplicate, usually ligulate and coriaceous, rarely fleshy. Inflorescences 1-many, apparently reduced to 1-several elongate 1-flowered peduncles per bract (rhizome scale) at the pseudobulb base; ovary usually without pedicel. Flowers campanulate to spreading, of various colors, sometimes sweetly or offensively odoriferous. Sepals subequal, the lateral sepals somewhat adnate to the column foot and forming a chin at the base, rarely connate. Petals similar to the sepals but usually smaller, the lip concave, 3-lobate or entire, the disk usually with a fleshy or mealy, less often oily or waxy callus. Column semiterete, rarely winged, and usually with a conspicuous foot; pollinia 4, waxy.

A Neotropical genus of at least 450 species; 107 species in Costa Rica. The genus is best recognized by the combination of conduplicate leaves, apparently one-flowered scapose inflorescences, the presence of a column foot, four pollinia supported on a short to long stipe, and a distinct, usually horseshoe-shaped viscidium.

The relationships of *Maxillaria* are not clear. We suggest that certain Brazilian species of *Maxillaria* (e.g., *M. picta* Hook.) are more closely related to *Trigonidium* than to other species of *Maxillaria*. Also, *Mormolyca ringens* (Lindl.) Schltr. exhibits rugose leaves with raised veins, pedicellate ovaries, and a lip shape similar to that of the *Maxillaria rufescens* Lindl. complex. One species in the Costa Rican flora, *Maxillaria tigrina* C. Schweinf., has the vegetative and floral aspect of the otherwise South American genus, *Chrysocycnis*, but the pollinia are odd for that genus. Clearly, much needs to be done to improve generic realignment in the Maxillariinae.

Keys to the Species of Maxillaria

Ia.	Plants always with elongate stems that lack pseudobulbs; pseudobulbs if present restricted	I to base
	of plant (e.g., Figs. 2B–5D).	2
	2a. Leaf blades ≥ 30 cm, < 1 cm wide; plant pendent	M. lueri
	2b. Blades if 30 cm long then much wider; plant various	3
	3a. Leaf axils never with > 1 scape	4
	4a. Sepals > 1.6 cm long, at least some leaves > 1.5 cm wide	5
	5a. Sepals < 2 cm long	. alfaroi
	5b. Sepals > 2.5 cm long	inaudita
	4b. Sepals < 1.5 cm long; leaves < 1.3 cm wide	6

	6a. Lip spatulate, midlobe > 2 times wider than isthmus <i>M. valerioi</i> 6b. Lip not as above
	7a. Ovary > 2.5 cm long
	8a. Leaves elliptic, thin; plants pendent M. appendiculoides 8b. Leaves lanceolate, chartaceous; plants usually stiffly erect
	M. dendrobioides
3b. Z	At least some leaf axils with > 1 scape
	9a. Column (excluding anther) ≤ 4 mm long
	10a. Ratio: foot length/column length < 0.2
	11a. Leaves > 3 cm wide <i>M. trilobata</i>
	11b. Leaves < 2 cm wide
	12a. Leaves acute; column about 2 mm long M. adendrobium
	12b. Leaves obtuse and unequally 2-lobate; column about 4 mm long
	10b Parior fact langth/achima langth > 0.2
	10b. Ratio: foot length/column length ≥ 0.2
	14a. Lip forming a sharp angle with column foot and usually readily
	movable
	15a. Leaves lanceolate, sessile, < 2 cm wide
	16a. Sepals and petals yellow, column ≤ 2.5 mm long ex-
	cluding anther and foot M. parvilabia
	16b. Sepals and petals brick red to brown or green, column
	> 4 mm long
	15b. Leaves elliptic, long petiolate, > 3 cm wide M. trilobata
	14b. Lip continuous with column foot, more or less rigid, not forming
	a sharp angle
	17a. Lip with simple callus at base lacking adornments
	17b. Lip with keels, papillae, or warts at base in addition to
	fleshy callus
	18a. Tepals greenish, reddish, or brownish M. tonduzii
	18b. Tepals lavender to white
	19a. Lip subsaccate, ovary ≤ 11 mm long
	M. adolphii
	19b. Lip not saccate, ovary > 11 mm long
	M. quadrata
	13b. Sepals < 1 cm long
	20a. Lip with a pair of rounded lobes at base M. conduplicata
	20b. Lip lacking side lobes
	21a. Flowers blood red and yellow M. fulgens
	21b. Flowers mauve to whitish or lavender M. pittieri
	9b. The same ≥ 4.5 mm long
	what swollen at ends
	23a. Ratio: midlobe (suborbicular)/lip $\leq \frac{1}{4}$ M. exaltata
	23b. Ratio: midlobe (lance-ovate)/lip $\geq \frac{1}{3}$
	22b. Ratio: foot length/column (less anther) length ≤ 0.25 , stem branches never
	swollen at apex
	24a. Column ≥ 7 mm long
	25a. Column (without anther) 7.5–8 mm long M. falcata
	25b. Column 9-10 mm long (without anther), lip keeled on callus

		25c. Column 13–15 mm long (without anther), lip not keeled (very shortly so in plants from Panama)
		26a. Leaves < 1.5 cm wide
	-	26b. Leaves > 3.5 cm wide
1b.		s various but elongate stems (if present) with pseudobulbs
	27a.	Plants with apically ≥ 2-foliate pseudobulbs
		28a. Plants with upright, decumbent or pendent, aerial canes
		30a. Flowers dark purple
		30b. Flowers greenish to white, lip with red stain
		29b. Largest leaves > 10 cm long; sepals > 12 mm long
		31a. Flowers red to orange
		31b. Flowers white to yellow
		32a. Sepals and petals long-attenuate, ≤ 4 mm wide M. ctenostachya
		32b. Sepals and petals oblong-elliptic, > 5 mm wide M. camaridii
		28b. Plants often creeping, but never with aerial canes
		33a. Column 9–11 mm long
		33b. Column 12–14 mm long M. scorpioidea 33c. Column > 1.5 cm long M. aciantha
	27h	Pseudobulbs apically 1-foliate or pseudobulbs lacking altogether
	270.	34a. Plants with distinct rhizomes or canes separating pseudobulbs; usually some rhizomes
		aerial
		34b. Plants distinctly cespitose, lacking elongate rhizomes or canes Key 2
		nizomes or Canes with Pseudobulbs, Some Aerial
	Late	ral sepals partially united beyond column foot (e.g., Figs. 9B–10B)
	Later 2a.	ral sepals partially united beyond column foot (e.g., Figs. 9B–10B)
	Later 2a.	ral sepals partially united beyond column foot (e.g., Figs. 9B–10B)
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	Later 2a.	ral sepals partially united beyond column foot (e.g., Figs. 9B–10B)
	Later 2a.	ral sepals partially united beyond column foot (e.g., Figs. 9B–10B)
	Later 2a.	Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base
	Later 2a.	Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base
	Later 2a.	Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base
1a.	Later 2a. 2b.	Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base
1a.	Later 2a. 2b.	Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base
1a.	Later 2a. 2b.	Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base
1a.	Later 2a. 2b.	Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base
1a.	Later 2a. 2b.	Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base
1a.	Later 2a. 2b.	Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base

7b.	Stem a and ori 12a. S	Ob. Lip 1 11a. 11b. apex clear iginal des sheaths su 3a. Pseud	with pair of rounded lobes at base
	13		lobulbs > 1.5 cm long; foot much shorter than column; leaves never subterete
			Sepals > 1.7 cm long
		14b.	Sepals < 1.5 cm long
	2	0a. Colu 0b. Colu	at base of pseudobulb foliaceous or at least with articulation
			26a. Pseudobulbs distinctly grooved or fluted; ratio: lip length/sepal length < 3/5
			24b. Midlobe $< \frac{3}{3}$ length of lip
			28 28a. Column foot ≥ ½ column length less anther, clearly differentiated from base of lip

29a. Column less anther > 6 mm long
30a. Column less anther < 11 mm long M. sigmoidea
30b. Column less anther > 13 mm long M. vaginalis
29b. Column less anther < 6 mm long
31a. Column less anther < 2 mm long M. minor
31b. Column less anther > 2.5 mm long
32b. Flowers pink, lavender, white, or yellowish
33a. Lower quarter of lip subsaccate; midlobe <
½ lip; flowers light lavender to white
M. schlechteriana
33b. Lower quarter of lip not at all saccate; mid-
lobe $> \frac{1}{2}$ lip; flowers yellowish to pinkish
M. dichotoma
21b. Petiole not abruptly narrowed above articulation; leaves ≥ 2 mm wide 34
34a. Blades of rhizome sheaths subtending flowers appearing half-lyre-
shaped from side (e.g., Figs. 14D–15B)
35a. Sepals and petals pure white
36a. All leaves ≤ 1.8 cm wide
36b. Some, if not all, leaves ≥ 1.8 cm wide M. ampliflora 35b. Sepals and petals otherwise
37a. Column < 6 mm long M. umbratilis
37b. Column > 6 mm long
38a. Lip when spread wider than long
39a. Sepals > 3.4 cm long M. ampliflora
39b. Sepals < 3.3 cm long M. bradeorum
38b. Lip when spread narrower than long
M. campanulata
34b. Sheaths various but not appearing half-lyre-shaped from side 40
40a. Sepals ≥ 1.7 cm long
41a. Leaves ≤ 1 cm wide
42a. Plant with distinctly foliaceous bracts subtending
pseudobulb
43a. Columns less anther < 6 mm long 44
44a. Ovary trigonous; fruit 3-alate
44b. Ovary terete, fruit not 3-alate
43b. Column less anther > 6 mm long 45
45a. Midlobe of lip suborbicular, serrulate
45b. Midlobe of lip otherwise
47a. Leaves < 2 cm wide
M. camaridii
47b. Leaves > 2.5 cm wide
M. suaveolens
46b. Flowers orange to red or purple 48
48a. Ovary with pedicel > 3 cm long
M. elatior
48b. Ovary with pedicel < 2 cm long
M. tubercularis
42b. Bract at base of pseudobulb usually with articulation

but rarely with a distinct broadened blade; lip not ser-
rulate
49a. Flowers clearly white with yellow on lip
M. alba
49b. Flowers green, whitish, or yellowish
40b. Sepals < 1.6 cm long
50a. Youngest rhizome concealed by several foliaceous sheaths
with fully developed blades
51a. Flowers dark purple M. ponerantha
51b. Flowers light green with red stain on lip
M. acervata
50a. Youngest rhizome concealed by 0-3 blade-bearing sheaths,
rest non-blade-bearing
52a. Leaves never obtuse and deeply emarginate, larger >
7 cm long
53a. Flowers red with yellow lip M. fulgens
53b. Flowers otherwise
54a. Leaves > 1.2 cm wide, scapes appearing
precociously on new shoots M. diuturna
54b. Leaves < 1.1 cm wide, scapes appearing at
base of mature shoots M. oreocharis
52b. Leaves obtuse and deeply emarginate, < 6 cm long,
elliptic
•
55a. Sepals > 11 mm long M. lankesteri 55b. Sepals < 9 mm long M. wercklei
JJD. Sedais \ 9 inin iong M. wercklei

Key 2: No Conspicuous Rhizomes or Canes

1a. Shoots with ≥ 3 leaves arranged in fan, or if pseudobulbs present, always with ≥ 3 subtending, foliaceous sheaths, leaves never broadly elliptic with petiole ≤ 3 mm broad (see Figs. 17B–18D)
2a. Plants with conspicuous pseudobulbs
3a. Sepals < 2.2 cm long
3b. Sepals 2.3–2.6 cm long
3c. Sepals > 3 cm long
2b. Plants lacking pseudobulbs, or these hidden by foliaceous sheaths
4a. Plant pendent, psygmoid, handlike; leaves equitant, iris-like M. valenzuelana
4b. Plant and leaf otherwise
5a. Column foot longer than column M. angustissima
5b. Column foot shorter than column
6a. Leaves not abruptly narrowed above the articulation, thick, obtuse
M. crassifolia
6b. Leaves abruptly narrowed above articulation, thin, distinctly acute 7
7a. Leaves ≤ 1.3 cm wide with unspotted sheaths, flowers wine red
M. bicallosa
7b. Leaves > 1.7 cm wide with spotted sheaths, flowers yellow
1b. Shoots always with pseudobulbs, rarely with 3 foliaceous sheaths at base

		Flow	rers pure white with yellow on lip
			12b. Leaf > 1 cm wide, elliptic, long-petiolate M. longipetiolata
		11b.	Sepals < 1.8 cm long
		110.	13a. Sepals < 8 mm long
			13b. Sepals > 8 mm long
			14a. Flowers orange-yenow with red on hip
			sis
9h	Scan	e exe	rted beyond subtending rhizome bract
, ,	15a.	Leav	res < 1.1 cm wide
			Sepals partially united beyond column foot M. strumata
		16b.	Sepals not so united
			17a. Leaves < 12 cm long
			17b. Leaves > 12 cm long
			18a. Flowers with spreading sepals, column > 1 cm long
			18b. Flowers campanulate; column < 1 cm long M. oreocharis
	15h	Lagr	res ≥ 1.1 cm wide
	150.		Petals lanceolate, distinctly broadest on the lower ¼
		ı yu.	20a. Midlobe of lip fleshy, black, reflexed, and forming an angle of about
			90° with base
			20b. Midlobe yellow and white, often with purple spots, neither black, nor
			so reflexed
			21a. Flowers ≥ 2 per rhizome bract; lip < 1.6 cm long <i>M. ringens</i>
			21b. Flowers 1(-2?) per rhizome bract; lip > 2 cm long 22
			22a. Pseudobulbs usually truncate apically; sepals \geq 5.5 cm long
			22b. Pseudobulbs usually conic, not truncate; sepals \leq 5 cm long
			22b. Escudobulos usually conic, not truncate, sepais \(\geq \) Cili long
		19b.	Petals various, but not broadest on lower ¼
		1,0.	23a. Midlobe of lip $\leq \frac{1}{3}$ as long as lip
			24a. Lip apex reflexed black, lance-ovate M. longiloba
			24b. Lip apex straight, sometimes with purple spots, not black 25
			25a. Pseudobulb suborbicular, small, and hidden by subtending
			bracts
			25b. Pseudobulb ovoid, emerging from subtending bracts
			23b. Midlobe of lip > ½ length of lip
			26a. Petals distinctly spatulate or oblanceolate M. piestopus
			26b. Petals distinctly not spatulate or oblanceolate
			27a. Inflorescence shorter than pseudobulb
			28a. Petiole $\geq \frac{1}{4}$ as long as blade M. longipetiolata
			28b. Petiole < ¼ as long as blade
			29a. Sepals and petals maroon to brown
			M. dressleriana
			29b. Sepals and petals cream-white to yellow 30
			30a. Lip orange
			30b. Lip yellow with red stripe up center M. acutifolia
			30c. Lip otherwise, usually yellow with red dots
			or stained dark
			27h Inflorescence longer than pseudobulb 31

38

31a. Lip orange, midlobe broadly lanceolate
M. hedwigiae
31b. Lip red, purplish, or cream spotted with maroon, mid-
lobe ovate (cucullata group)
32a. Flowers with sepals and petals stained with pur-
ple; midlobe of lip with truncate to emarginate
callus M. obscura
32b. Flowers with lines of purple dots on sepals and
petals, lip usually dark red or maroon
M. punctostriata
32c. Flowers with white sepals and petals, lip cream
spotted with maroon M. cedralensis
8b. Pseudobulb subtended by ≥ 1 foliaceous sheath, at least when young
33a. Sepals > 10 cm long
33b. Sepals < 10 cm long
34a. Foot at least as long as column less anther
35a. Sepals < 2.7 cm long
36a. Flowers held much higher than shoots; lip twice length of foot plus
column less anther
36b. Flowers much shorter than shoots; lip not much longer than foot plus
column less anther
37a. Anther bed lacerate; lateral sepals attenuate, ≥ 1.8 cm long
37b. Anther bed not at all lacerate; lateral sepals not attenuate, ≤ 1.8
cm long
35b. Sepals > 2.8 cm long
38b. Leaves lacking such spots
39a. Sepals \geq 5.5 cm long
39b. Sepals \leq 5 cm long
34b. Foot shorter than column
40a. Lip subentire to indistinctly 3-lobate
40b. Lip distinctly and deeply 3-lobate near the apex
41a. Sepals ≥ 1.4 cm long
42a. Sepals \geq 3.5 cm long; flowers generally held higher than the
shoots
42b. Sepals \leq 3 cm long; flowers much shorter than shoots 43
43a. Plants < 12 cm tall, ovary with pedicel < 1.7 cm long
M. brachybulbon
43b. Plants > 25 cm tall, ovary with pedicel > 2.5 cm long
41b. Sepals ≤ 1.3 cm long
44a. Sepals < 6 mm long, column foot nearly absent
M. vittariifolia
44b. Sepals > 8 mm long, column foot nearly as long as column

Maxillaria acervata Rchb. f., Bonplandia 3:217. 1855. TYPE: Costa Rica, "Ad Suru[n]gnes," *Oersted s.n.* (lectotype selected here: w; isolectotype: K). *Maxillaria foliosa* Ames & C. Schweinf., Sched. Orch. 8:60. 1925. TYPE: Costa Rica, *C. H. Lankester 478* (holotype: AMES). Figure 7D.

Plant epiphytic, somewhat straggly, especially in lower elevation specimens, to 30 cm tall, rooted only at the base; shoots ascending, 3–9 cm apart. Roots white, to 1 mm in diameter. Pseudobulbs 2(1)-foliate, ovoid, compressed, 1–3 cm long, about 1 cm wide, concealed when young by leaf-bearing sheaths. Leaves and leaf-bearing sheaths to more than 20 in developing shoots, all except the apical leaves of the pseudobulbs abscising at matu-

rity, oblong-lanceolate, 1.5–6 cm long, 5–10 mm wide, obtuse to unequally 2-lobate. **Inflorescence** 1 per sheath axil in the immature shoot; scape about 1 cm long, concealed by few acute sheaths; ovary with pedicel 1.5–2 cm long, exceeding the subtending bract. **Flowers** erect, green to white, the lip with red stain on the lower ½. **Sepals** ovate, elliptic, obtuse, apiculate, 1 cm long, 4 mm wide. **Petals** elliptic, 9 mm long, 3.5 mm wide. **Lip** hinged to the column foot, simple, spatulate, 1 cm long, 4 mm wide; callus oblong, extended to just beyond the middle, obtuse or rounded apically. **Column** arcuate, expanded above, 7 mm long; foot 2 mm long; pollinia 4 lacking a stipe but with saddle-shaped viscidium. **Capsule** ellipsoid, 2 cm long.

Epiphytic in primary montane and premontane evergreen forests at 700–2000 m. Flowering September to March. Nicaragua to Panama; also reported from Ecuador as *M. foliosa*.

This species is closely related to *M. ponerantha* Rchb. f., but the plant is somewhat larger, and the flowers are light green with red on the lower half of the lip. *Maxillaria ponerantha* is a somewhat smaller, more widespread, lowland species with dark purple flowers. The pseudobulbs are nearly always apically 2-foliate in *M. acervata* and 1-foliate in Costa Rican *M. ponerantha*. Leaf-bearing rhizome bracts of immature shoots in *M. foliosa* may exceed 20. Lower elevation examples are much less compact than upper elevation conspecifics.

Authors usually treat this as the synonym *M. foliosa* (e.g., Hamer, Icon. Pl. Trop 9: Plate 854; Atwood, Icon. Pl. Trop 14: Plate 1346). Both available types of *M. acervata* agree in the rhizomatous habit, the foliaceous sheaths at the base of the pseudobulbs, and the rather simple flowers.

Maxillaria aciantha Rchb. f., Bot. Zeitung (Berlin) 10:858. 1852. TYPE: Costa Rica, *J. de Warszewicz s.n.* (not seen). *Lycaste aciantha* (Rchb. f.) Rchb. f., Bonplandia 3:216. 1855. Figure 9A.

Plant a loosely cespitose to straggly epiphyte, rarely forming large clumps, some of the shoots to 3 cm apart; often pendent with only basal shoots rooted. Roots fibrous, white, to 1 mm in diameter. Pseudobulbs cylindric-fusiform, 3–8 cm tall and 0.7–1.2 cm wide, laterally flattened and with several vertical ribs conspicuous especially when dried, subtended by 1–3 early deciduous, blade-bearing bracts, apically 2–4 foliate. Leaves linear to elliptic-oblong, 3–15 cm long and 0.8–1.6 cm wide, unequally 2-lobed apically. Inflorescence lateral, 1-flowered, borne singly per rhizome bract, the peduncle about 1.5 cm long covered by 3–5 inflated bracts, with the uppermost bract subtending the flower 2.0–2.7 cm long; ovary with pedicel to 2 cm long at anthesis, usually much longer than the upper of 2 subtending bracts,

soon elongating after pollination. Flowers coriaceous, persistent in fruit, cartilaginous, not opening fully and difficult to spread, brick red to yellowish green with red stain on the inner surface, lip dark red. Sepals similar; dorsal lanceolate, acute, concave, apically carinate, 2.5–3.2 cm long, 5–6 mm wide; lateral sepals narrowly ovate, falcate, 2.5–3 cm long, 5–7 mm wide. Petals narrower than the sepals, falcate, 2.2–2.8 cm long. Lip hinged to the column foot, elliptic-oblong to narrowly rhombic, arcuate, thickened along the margin and at the apex, 2–2.6 cm long and 5–6 mm wide; callus linear from the base to just below the middle, the apical fifth appearing oily internally. Column cylindric about 1.7–2.2 cm long; a foot 3 mm long; pollinia 4, supported on a stipe 3 mm long; anther bed ciliate at the margin. Capsule ellipsoid, 3–4 cm long.

A locally common epiphyte of wet forests, 50 to perhaps 1000 m. Uncommon from Mexico (Campeche? and Chiapas) to Chiriquí, Panama; possibly in Colombia and Peru. Flowering mostly October to February. In Central America, *M. aciantha* is found almost exclusively in the Caribbean drainage.

This is closely related to sympatric *M. fried-richsthalii*, and the two species sometimes occur on the same host tree. The shoots and flowers of *M. aciantha* are conspicuously larger, and the flower color is reddish to yellow-green, never white. It also differs from closely related *M. scorpioidea* Kraenzl, by the larger flowers with dark red, unspotted lip. That species is almost exclusively restricted to the Pacific drainage.

Maxillaria acostae Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:301. 1923. TYPE: Costa Rica, near San Ramón, *Acosta s.n.* (neotype selected here: AMES 40543). Figure 25C.

Plant a small, cespitose epiphyte rarely to 20 cm tall. Roots to 0.5 mm in diameter. Pseudobulbs ovoid, 1-2 cm long, subtended by nonfoliaceous, triangular sheaths transversely spotted with purple; apex 1-foliate. Leaves with petiole 1/4-1/2 the blade length; blade somewhat coriaceous, narrowly to broadly elliptic, 22-100 mm long, 4-17 mm wide, acute to obtuse or acuminate. Inflorescences 1-2 per rhizome bract axil of the mature shoot; scape 2-3 cm long, concealed by spotted, acuminate sheaths; ovary with pedicel 7-11 mm long, somewhat exceeded by the floral bract. Flowers white turning orange-brown, the lip with crimson callus and midlobe. Sepals dissimilar; dorsal lance-oblong, obtuse to acute, 1-1.2 cm long, 3-4 mm wide; lateral sepals oblique, oblong, 1.2-1.3 cm long, 3.5-4.5 mm wide, acute to obtuse. Petals lanceolate-elliptic to oblanceolate, 1 cm long, 2.5–3 mm wide, acute to obtuse. Lip hinged to the column foot, cuneate to obovate, 9-11 mm long, 3-5.5 mm wide when spread, the apical ½ deeply 3-lobate; lateral lobes embracing the column rounded; midlobe suborbicular to ovate, somewhat recurved; callus an oblong, fleshy ligule ending about 3/5 from the base. Column arcuate, 5-6 mm long excluding the anther; foot 2.5–3.5 mm long; anther about 2 mm long. Capsule ellipsoid, about 1.5 cm long.

Epiphytic at 650-1500 m. Flowering March to December. Rarely collected, perhaps because of its small size. Costa Rica and Panama.

There appear to be two kinds of M. acostae with identical flowers but different leaves, those with a maximum leaf width-to-length ratio of \geq 0.14 and those with a ratio of \leq 0.11. Both vegetative types are known from Costa Rica and Panama, but the vertical range of the broad leaf form is 650–1000 m, while that of the narrow leaf form is 1050–1500. There may be two distinct species represented here, but the apparently identical flowers do not support this. Similar leaf width-to-length ratios taken from the type description are 0.09 and 0.10, corresponding with higher elevation forms. None of this form has been recently collected. The designated neotype is all that has been found of the original materials.

Maxillaria acutifolia Lindl., Edwards's Bot. Reg. 25: misc. 92. 1839. TYPE: Demerara, *Loddiges s.n.* (holotype: κ). Not *Maxillaria acutifolia* Schltr. Figure 21B.

Plant a cespitose epiphyte rarely forming large clumps; shoots to about 1 cm between pseudobulbs. Roots fibrous, to about 1 mm in diameter. Pseudobulbs 1-foliate, cylindric, to about 6 cm long and 1.5 cm in diameter. Leaf shortly petiolate, narrowly elliptic, to 21 cm long and 1.5 cm wide, acute. Inflorescence usually shorter than the pseudobulbs; ovary with pedicel 1.3-1.8 cm long. Flower dull yellow, the lip yellow with red spots and a red central line. Sepals similar, 1.2-1.5 cm long, about 4 mm wide; dorsal oblong-lanceolate, lateral sepals somewhat oblique, falcate, acute to obtuse. Petals elliptic, 1-1.4 cm long, 2-3 mm wide, acute. Lip articulated with the short column foot, 3-lobate below the middle, 1-1.2 cm long; lateral lobes acute; midlobe more or less oblong, truncate, and retuse. Column arcuate, clavate, 7 mm long, with a short foot about 2 mm long.

Tropical forests at 0–1350 m. Flowering December to February. Local from Honduras to Ecuador and at least northern South America.

This is one of the two smaller flowered species of the *M. rufescens* complex in Costa Rica, the other being *M. dressleri*, with wine red to maroon flowers. *Maxillaria acutifolia* differs most strikingly in the more or less cylindric, not ovoid pseudobulb and relatively narrow leaf. In live material the red line up the center of the lip is the most distinctive floral feature of the species. *Maxillaria hedwigiae* is a larger plant with proportionately broader pseudo-

bulbs. Plants accepted here as *M. acutifolia* have a somewhat more cuneate midlobe than the type and may prove to be the same as *M. moralesii*, in which case the latter name should be used.

Maxillaria adendrobium (Rchb. f.) Dressler, Taxon 13:248. 1964. Ponera adendrobium Rchb. f., Flora 48:278. 1865. TYPE: Cuba, Wright 1697 (isotypes: AMES 6081, 6082) Pleuranthium adendrobium (Rchb. f.) Benth. & Hook. f., J. Linn. Soc. 18:312. 1881. Neourbania adendrobium (Rchb. f.) Fawc. & Rendle, J. Bot. 47:125. 1909. Figure 4A.

Plant sometimes more than 1 m tall lacking pseudobulbs; stems somewhat fractiflex, pendent, apparently monopodial, mostly concealed by leaf sheaths. Roots appearing along the entire stem to 2.5 mm in diameter. Leaves coriaceous, narrowly elliptic, articulate to the sheaths, usually deciduous below, 5.5-11 cm long, 7-15 mm wide, acute. **Inflorescences** 1–few per leaf axil, not much exerted beyond the subtending sheath; ovary with pedicel about 10 mm long, subtended by a shorter, triangular bract. Flowers pale green to yellow, purplish toward the base; column dark. Sepals subequal, narrowly ovate, 5.5-7 mm long, about 2 mm wide, acute. **Petals** narrowly ovate, 5 mm long, 2 mm wide, acute. **Lip** attached to the column foot, 3-lobate, about 5 mm long; lateral lobes short, ovate; midlobe large, ovate-elliptic, retuse, conspicuously mucronate abaxially near the apex; margins somewhat crenate; callus globose at the base of the midlobe. Column stout, about 2 mm long; foot at approximately a right angle with the column, about 2 mm long. Capsule ellipsoid, about 1.3 cm long.

Epiphytic mostly in rain forests at 350–850 m. Flowering September to November. Costa Rica, Panama, Jamaica, and Cuba; doubtfully reported from Ecuador on the basis of a similar plant with a different lip.

Maxillaria adolphii Ames & Correll, Bot. Mus. Leafl. 11:18. 1943. Camaridium adolphii Schltr. (invalidly published), Repert. Spec. Nov. Regni Veg. Beih. 19:58. 1923. Ornithidium tonduzii Schltr., Repert. Spec. Nov. Regni Veg. 3:250–251. 1907. TYPE: Costa Rica, on the banks of the Rio Angel (Poas), Tonduz 10770 (lectotype selected here: US 938677; isolectotype: US 577310; drawing of type: AMES). Not Maxillaria tonduzii (Schltr.) Ames & Correll. 1943. Not Camaridium tonduzii Schltr. 1910. Figure 5C.

Plant a large, cane-forming, apparently monopodial epiphyte or terrestrial to 2 m tall, often becoming pendent with size; juveniles cespitose, sympodial with each shoot terminating in a pseudobulb. Mature stems sheathed with closely spaced, conduplicate leaves, most-

ly deciduous near the base with sheaths fragmenting into fibers. Roots slender, to about 1 mm in diameter. Pseudobulbs of juveniles to about 10 cm long, subtended by 1 or more foliaceous sheaths, the apex 1(-2?)-foliate. Leaves articulate, coriaceous, keeled beneath, shortly petiolate above the articulation; blades 5-20 cm long, 1.2-2.8 cm wide; apex unequally 2-lobate. Inflorescences several to many per leaf axil; scapes to nearly 10 cm long but not much exerted beyond the subtending leaf blade, clothed in acute sheaths; ovary with pedicel 8.5-11 mm long, usually exceeded by the subtending floral bract. Flowers fragrant, with somewhat recurved segments, pinkish lavender to white, the lip purple. Sepals similar, oblong-oblanceolate, 1.4–1.9 cm long, 4–5 mm wide, the apex acute and externally keeled; petals elliptic-oblanceolate, 1.2-1.4 cm long, 4-5 mm wide, the apex acute. Lip rigid with the column foot, subsaccate on the lower half, 3-lobate above the middle, 4-7 mm long, 2.5-4 mm wide in natural position; lateral lobes little extended beyond the sinuses, rounded; midlobe ovate, rounded to emarginate, recurved; callus a truncate ligule ending just below the lobe sinuses with an additional 3 or more papillae at the base. Column stout, 3-4 mm long excluding the anther, the anther about 1.5 mm in diameter. Capsules ellipsoid, about 1 cm long.

Epiphytic or terrestrial fully exposed in windy, cold cloud forests at 2200-3300 m. Flowering November to August. Endemic to Costa Rica and western Panama.

Maxillaria adolphii is distinguished from closely related M. biolleyi (Schltr.) L. O. Williams by the more saccate lip with relatively complex callus that is papillose at the base and by a pair of lateral lobes distally. Maxillaria biolleyi has orange in the lip, a much more simple callus lacking papillae, and a pair of lateral lobes at the base. Available herbarium specimens with flowers intermediate with M. biolleyi suggest that natural hybrids may occur. Similar Maxillaria quadrata with nonsaccate lip may prove to be a variant of M. adolphii.

The nomenclature of *M. adolphii* was confused when Schlechter indicated that *Ornithidium tonduzii* Schltr. "might" (*möge*) be called *C. adolphii* Schltr. in the future but did not accept the new name at the time of publication, thus rendering it invalidly published. Although Ames and Correll published the combination as *M. adolphii*, it must be accepted as a new name. The lectotype is the more complete of two isotypes that surfaced at us and is provided with floral analysis.

Maxillaria alba (Hook. f.) Lindl., Gen. & Sp. Orch. Pl. 143. 1832. *Dendrobium album* Hook. f., Exot. Fl. t. 142. 1825. TYPE: Jamaica (holotype: κ). *Broughtonia alba* (Hook. f.) Spreng.,

Syst. Veg. 3:735. 1826. *Camaridium album* (Hook. f.) Hoehne, Arq. Bot. Est. São Paulo 2(4):72. 1947. *?Maxillaria hedyosma* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 42:131. 1925. Figure 15D.

Plant epiphytic with ascending rhizomes, each terminated in a pseudobulb and rooted only at the base; successive shoots 1.5-6 cm apart. Roots white, to 1.5 mm in diameter. Pseudobulbs ancipitous, ovate, smooth, 2.5-6 cm long, 1-2.5 cm broad, 1-foliate; articulation usually oblique, subtended by sheaths often with soon deciduous blades. Leaves shortly petiolate, subcoriaceous, linear to narrowly elliptic, 20-40 cm long, 1.4-2.5 cm wide, tapering to an obtuse apex. Inflorescences 1 in each of several rhizome bract axils of the developing shoot; scapes 2-3 cm long, hidden by the subtending rhizome bract; ovary with pedicel 2.5-3.5 long, much exceeding the attenuate floral bract. Flowers fragrant, white, the lip creamy white with yellow apex. **Sepals** lanceolate, acuminate, 2.2–2.5 cm long, 5–7 mm wide. Petals obliquely lanceolate, 1.8-2.2 cm long, 5-6 mm wide, acute. Lip articulated to the column foot, ovate, puberulent, lightly 3-lobate on the apical 1/3, 1.3-1.6 cm long, 4-6 mm wide; callus extending to just beyond the middle, parabolic in front. Column arcuate, about 1 cm long; foot 3 mm long. Capsule ellipsoid.

Large crown epiphyte of wet forests at 250–1200 m. Flowering throughout the year. Guatemala to Panama, Jamaica, Cuba, and much of tropical South America.

This is most similar to *M. anceps* Ames & C. Schweinf. and *M. nagelii* L. O. Williams (not in Costa Rica), both of higher elevations, with decidedly greenish flowers and more conspicuous callus. It also resembles *M. oreocharis* Schltr., a species with smaller, reddish-stained flowers that form at the base of mature shoots.

Maxillaria alfaroi Ames & C. Schweinf., Sched. Orch. 10:83–84. 1930. TYPE: Costa Rica, Carretera Fuentes, *Alfaro 284* (holotype: AMES). Figure 2B.

Plant stout, with erect stems perhaps 50 or more cm tall, apparently lacking pseudobulbs; stems erect, concealed by the distichous, imbricate, conduplicate leaf sheaths. Roots large, 2.5 mm in diameter. Leaves linear-oblong to narrowly elliptic, to 23 cm long, 2.5 cm wide, becoming smaller toward the stem apex, the midvein sulcate above and carinate below; blade articulate to the sheath base; apex rather abruptly narrowed, obtuse or rounded. Inflorescence single per leaf axil, the scape to about 8 cm long and concealed by several acute sheaths. Flowers orange-yellow. Sepals dissimilar; dorsal concave, oblong-ovate, about 1.9 cm long, 8–9 mm wide, acute and mucronate; lateral sepals somewhat oblique, broadly lanceolate, 1.9 cm long, about 7 mm wide, acute and mucronate. Petals ovate-oblong, 1.6 cm long, 6.5–

7 mm wide, acute, somewhat oblique. **Lip** simple, subquadrate-oblong, slightly constricted in the middle, about 1.4 cm long, 6.5 mm wide; apex broadly rounded and somewhat retuse. **Column** stout, strongly arcuate, 7–8.5 mm long. **Capsule** apparently narrowly ellipsoid.

Maxillaria alfaroi is represented here only by the type collection and by a photograph of a single plant in a live collection in British Columbia. The above description is condensed from the original and augmented from a photograph of the single live plant. Little is known of its ecology except that the type was collected at 1400 m and in flower in August. It appears to be related to, if not identical with, M. densifolia (Poeppig & Endl.) Rchb. f. from South America. It should be easily recognized by the relatively large canes lacking pseudobulbs and the rather simple flower with simple lip.

Maxillaria amabilis J. T. Atwood, Lindleyana 9: 239–241. 1994. TYPE: Costa Rica: Province of Alajuela: Zona Protectora, Chayote, Llano Bonito, Naranjo, 1200 m, *L. D. Gomez, G. Herrera, & W. Murillo 23979* (holotype: MO; isotypes: F, SEL). Figure 7B.

Plant a large, erect, cane-forming epiphyte to at least 90 cm tall; canes of mature shoots lacking pseudobulbs, concealed by rugose leaf sheaths, mostly leafless on the lower canes. Roots mostly restricted to the base, to about 1.5 mm in diameter. Pseudobulbs present only at base (as cespitose juveniles), about 5 cm tall and 2.5 cm wide, compressed, sessile, subtended by 1-2 foliaceous sheaths, apically 1-foliate with shortly petiolate leaf. Leaves thin, articulate; blade keeled below, 4-7 cm long, 1.3-2.8 cm wide, the apex obtuse to rounded and unequally 2-lobate. Inflorescences several per leaf axil, long for the genus and sometimes exceeding the subtending leaf; scapes to about 9 cm long; ovary with pedicel 9-11 mm long, subtended by a subequal to longer subulate, acute floral bract. Flowers large for the genus, campanulate, to about 2.5 cm long, white to lavender, or the outer surfaces of sepals and petals with pink stripe, lip yellow or orange. Sepals similar, oblong-elliptic, 2.2-2.5 cm long, 4.5-6 mm wide, the apex acute and carinate externally. **Petals** oblanceolate, about 2.2 cm long, 5.5-6.5 mm wide, acute to acuminate. Lip loosely rigid with the column foot, canaliculate on the lower half, 3-lobate on the upper half, about 9 mm long and 3 mm wide in natural position, 1.2 cm long when spread; lateral lobes embracing the column; midlobe ovate, obtuse; callus a truncate lamina terminating at about the lobe sinuses with a keel on the lower ½ elevated and acute in front. Column nearly straight, cylindric, 9 mm long excluding foot and anther; foot short, about 2 mm long; anther about 1.5 mm in diameter.

Maxillaria amabilis is a poorly known epiphyte apparently of premontane and montane rain for-

ests at 1200–1900 m. Flowering at least in October and January. Endemic to Costa Rica.

Maxillaria ampliflora C. Schweinf., Bot. Mus. Leafl. 8:188. 1940. Camaridium grandiflorum Ames, Proc. Biol. Soc. Wash. 34:149–150. 1921. TYPE: Panama, Chiriquí, east of the Rio Caldera, Killip 3565 (holotype: AMES; isotype: US). Not Camaridium grandiflorum Schltr. Not Maxillaria grandiflora Lindl. Figure 14E.

Plant a straggly terrestrial or epiphyte forming erect to decumbent canes to about 2 m long; stems comprised of successively borne shoots, each terminated by a pseudobulb. Roots forming only on the lowest shoots, to 2.5 mm in diameter. Pseudobulbs ovoid, compressed, to about 5 cm long; base subtended by several leaves; apex 1-foliate. Leaves distinctly and shortly petiolate, conduplicate; blade narrowly elliptic, increasing in size toward apex within each shoot, to about 30 cm long, 4 cm wide, acute. Inflorescence 1(2) per bract axil, subtended by a foliaceous bract with distinct articulation; scapes sheathed in acute bracts, to about 7 cm long; ovary with pedicel 1.3-1.6 cm long, exceeded by the subtending floral bract. Flowers somewhat campanulate, white or pinkish to light yellow, the recurved segments lightly barred with lavender; lip white and yellow with reddish transverse bars. Sepals oblong to lanceolate, the apical margins often involute; dorsal 3.5-5 cm long, about 1 cm wide; lateral sepals somewhat oblique 3.5-5 cm long, about 1 cm wide, acute. Petals elliptic-lanceolate, 3.2-4.5 cm long, about 1 cm wide; apical margins somewhat involute; apex acute to attenuate. Lip hinged to the column foot, 3-lobate, about 1 cm long and wide when spread; lateral lobes somewhat clasping the column, rounded to bluntly acute, the midlobe rounded to acuminate, often with involute margin; callus a raised ligule ending at about the sinuses of the lobes, 3-dentate in front, papillose on the lower 3. Column arcuate, 8-10 mm long excluding the anther; anther about 2.5 mm in diameter.

Epiphytic and terrestrial in cloud forests at 1000–2100 m. Flowering January to March and August to October. Apparently more common in Panama than in Costa Rica, if available herbarium specimens are an indication. Also reported from Colombia and Ecuador as *M. bradeorum* (Schltr.) L. O. Williams (sensu lato).

Maxillaria ampliflora is most similar to M. bradeorum (Schltr.) L. O. Williams, a species with smaller flowers, more purple in the floral segments, and a lip with a proportionately smaller midlobe. These species are sympatric.

Maxillaria anceps Ames & C. Schweinf., Sched. Orch. 10:84. 1930. TYPE: Costa Rica, La Palma A. M. Brenes (133) 463 (holotype: AMES,

photo; isotype: CR). Not *Ornithidium anceps* Rchb. f. Figure 16A.

Plant large, epiphytic, with ascending shoots each terminated by a pseudobulb and borne 3.5-7 cm apart; rooted to the substrate only on lower shoots. Roots white, to 2 mm in diameter. Pseudobulbs ovoid, 1-foliate, strongly compressed, shiny, 2-5.5 cm long, 1-2.5 cm wide, subtended by rhizome bracts, which are soon deciduous along the oblique articulation, the apex 1-foliate. Leaves subcoriaceous, narrowly elliptic to oblong, shortly petiolate, the blade 6-30 cm long and 1-3.5 cm wide, apically obtuse to unequally bilobed. Inflorescences 1 per each of several rhizome bracts of the newly forming shoot; scapes 1-5 cm long, covered by 3 or more acute sheaths and usually concealed by the rhizome bract; ovary with pedicel 2.5-4 cm long, much longer than the subtending bract. Flowers fragrant, greenish white to yellow. Sepals lanceolate-ovate, 1.8-2.1 cm long, 6-7 mm wide. Petals elliptic-oblong, 1.6-1.8 cm long, 4-5 mm wide. Lip hinged to the column foot, ovate, strongly 3-lobate on the apical third, 1.5-1.7 cm long, 7-9 mm wide, thickened at the base, glabrous inside; callus orbicular just below the middle (difficult to rehydrate in pressed specimens). Column arcuate, about 1 cm long; foot about 2 mm long. Capsule ellipsoid, 3 cm long.

Large clump-forming epiphyte of tree trunks and larger branches in wet forests at 1000–1600 m. Flowering November to February. Guatemala to Costa Rica.

Maxillaria nagelii L. O. Williams, ranging from Mexico to Guatemala and El Salvador, is a similar middle elevation species with similar orbicular callus but with distinctly acute perianth segments and less distinctly 3-lobate lip. Maxillaria anceps also resembles M. alba (Hook. f.) Lindl., a species with white flowers and longer, more acute floral segments, a more pronounced 3-lobate lip, and ligulate callus extending beyond the middle. Maxillaria anceps also is more restricted in flowering season, geography, and elevation than the widespread M. alba.

Maxillaria angustisegmenta Ames, Hubbard, & C. Schweinf., Sched. Orch. 10:86–87. 1930. TYPE: Costa Rica, La Palma, A. M. Brenes (132) 462 (holotype: AMES). Maxillaria endresii Rchb. f. var. angustisegmenta (Ames, Hubbard & C. Schweinf.) C. Schweinf., nom. Maxillaria luteoalba of authors, not Lindl. Figure 20C.

Plant a densely cespitose epiphyte with approximate shoots. Roots white, to 1.5 mm in diameter. Pseudobulbs 1-foliate, conic to ovoid, rarely approaching orbicular, somewhat compressed, 2–7 cm long and 1.5–2.5 cm wide, partially concealed at the base by several smooth, chartaceous, minutely spotted, triangular, acute

bracts 3-10 cm long, shredding with age. Leaves long (rarely short) petiolate; petiole sometimes more than \(\frac{1}{3} \) the length of the blade; blade oblong-elliptic, 15-24 cm long and 2.5-6 cm wide, acute. Inflorescence 1-flowered, the scapes 4-15 cm long, concealed by 4-6 inflated and minutely spotted bracts; ovary with pedicel 2-3 cm long, enclosed and concealed by the floral bract before pollination. Flowers fragrant, mostly white, the inner surface of the sepals yellow, the lip yellow and centrally lined with purple on the side lobes, column white to purple. **Sepals** similar; dorsal elliptic-oblong, somewhat concave, 3-5 cm long, 7-10 mm wide, acute to obtuse; lateral sepals oblong, tapering from about the middle to a broadly acute apex, 3-5 cm long, 6-10 mm wide at the base. Petals narrowly elliptic, falcate, strongly incurved, 4 cm long and 4-7 mm wide, acute. Lip obovate, sharply 3-lobate on the apical quarter, 2.1-2.6 cm long, 12-18 mm wide; midlobe about 6 mm long, 6.5 mm wide; callus on the lower ½ puberulent, raised, thickened, and V-shaped in front. Column 1.8-2 cm long, including the 5-8-mm foot. Capsule 4 cm long.

Epiphyte of larger branches or less often terrestrial, often forming large clumps; mostly in cloud forests from (450)700–1800(2000) m. Flowering from October to March. Costa Rica and Panama.

This species is most similar to the earlier described and probably sister species, M. luteoalba Lindl. (TYPE: Venezuela, Linden 678, photo seen), which doubtfully occurs in Panama as reported. Maxillaria luteoalba has larger flowers and a proportionately larger midlobe and shorter callus in the lip. In Costa Rica M. angustisegmenta is easily distinguished from the lower elevation M. endresii Rchb. f. by the shorter and usually proportionately broader perianth parts (despite the name) and the proportionately smaller midlobe. The anther bed of M. endresii is coarsely and irregularly lacerate but low and minutely dentate in M. angustisegmenta. Vegetatively, the pseudobulb of M. endresii is nearly always suborbicular and truncate or emarginate, while that of M. angustisegmenta is ovoid to conic.

Maxillaria angustissima Ames, Hubbard, & C. Schweinf., Bot. Mus. Leafl. 3:41. 1934. *Maxillaria acutifolia* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:229–230. 1923 (not Lindl., 1839). TYPE: Costa Rica, San Ramón, *A. M. Brenes 235* (holotype: B, destroyed; drawing of type: AMES), *Brenes 173 (504)* (neotype: AMES). Figure 18B.

Plant a cespitose epiphyte; shoots approximate, often pendent, to 30 cm tall. Roots white, to 0.5 mm in diameter. **Pseudobulbs** hidden from view by 3–4 subtending, leaf-bearing rhizome bracts, apically 1-foliate.

Leaves linear, attenuate both toward the base and the apex, 5-25 cm long, 4-11 mm wide, the leaves subtending the pseudobulb with broadened sheaths below the articulation. Inflorescences lateral in the rhizome bract axils, the single-flowered scapes 1-3 cm long; ovary with pedicel about 1.5 cm long, subtended by a subequal, acute, floral bract. Flowers white to pink, the side lobes of the lip often reddish. Sepals dissimilar; dorsal ovate, concave, 9 mm long, 3.5-4 mm wide, apex strongly concave; lateral sepals triangular, adnate to the long column foot, 1.6 cm long, apex acute and strongly concave. Petals oblong, about 1 cm long, 3 mm wide, constricted just below the erose apex. Lip hinged to the column foot, cuneate, strongly 3-lobate on the apical fifth, 13-14 mm long, 4 mm wide, midlobe broadly acute; callus ligulate, pubescent, rather deep and parabolic in front, extending to just below the base of the midlobe. Column 4 mm long; foot 10 mm long. Capsule somewhat curved, narrowly ellipsoid, 3.5-4 cm long.

A rare epiphyte of wet forests at 900–1500 m. Flowering August and September. Costa Rica, Panama, and southern Nicaragua (Volcán Mombacho).

The very narrow leaves and small, hidden pseudobulbs along with the small white flowers produced in August and September are good features for field recognition.

Maxillaria appendiculoides C. Schweinf., Bot. Mus. Leafl. 4:119–121. 1937. TYPE: hills of San Pedro de San Ramón, *Brenes* (239) 1427 (holotype: AMES; isotype: NY). Figure 3B.

Plant a straggly, often pendent epiphyte; stems elongate, lacking pseudobulbs, concealed by sheaths. Roots white, to about 1 mm in diameter. Leaves distichous, deciduous on the lower stems, thin; blade elliptic to broadly lanceolate, 1-4 cm long, 5-13 mm wide, rounded and unequally 2-lobate apically. Inflorescence 1 per leaf axil, shorter than the subtending leaf; peduncle 1-2 cm long; ovary with pedicel about 1 cm long, subtended by a somewhat shorter, acute bract. Flowers yellow or greenish; lip with purple. Sepals ovate-lanceolate, somewhat concave, ovate-lanceolate, 8-9 mm long, 3-3.5 mm wide, lateral sepals somewhat oblique, acute. Petals narrowly elliptic-linear, somewhat falcate, acute, 6.5-7.5 mm long, 1.5-1.75 mm wide. Lip hinged to the foot, rhombic-ovate in outline when spread, somewhat 3-lobate above the middle, 6 mm long, 4.5-5 mm wide when spread; lateral lobes rounded and somewhat clasping the column; midlobe subquadrate, rounded to truncate; callus simple, from near the base to about the middle, ligulate, rounded in front. Column about 4 mm long excluding the anther; foot 2–2.5 mm long. Capsule ellipsoid about 1.5 cm long, separating into 6 valves, with persistent column.

Epiphytic and apparently rare in premontane rain forests around 800-1600 m. Flowering Au-

gust to November. Endemic to Costa Rica, although it may not have caught the eye of collectors because of its understated appearance.

Maxillaria appendiculoides is closely related to M. luteorubra (Lindl.) Rchb. f. from South America, a species with somewhat larger flowers. It is easily distinguished from sympatric M. linearifolia Ames & C. Schweinf. by the shorter and more elliptic leaves and lower elevation range.

Maxillaria arachnitiflora Ames & C. Schweinf., Sched. Orch. 10:87–89. 1930. TYPE: Costa Rica, Navarro, *C. H. Lankester 1212* (holotype: AMES). Figure 24C.

Plant a cespitose epiphyte, not forming large clumps. Roots white, to 1 mm in diameter. Pseudobulbs slender, to 4.5 cm long, concealed and subtended by 1-2 leafbearing rhizome bracts. Leaves petiolate, the petiole to ½ the blade length; blade narrowly to broadly elliptic, 8-20 cm long and 2-3.5 cm long, acute. Inflorescence usually not longer than the leaves, 5-8 cm long, nearly concealed by 5-6 obtuse, apiculate bracts 1-3 cm long; ovary with pedicel 2-3 cm long, surpassed by the subtending bract. Flowers with sepals creamy yellow, the petals white, lip yellow, column with maroon at base. Sepals 5.5-7 cm long, acuminate, apically spiraled or pendent; dorsal 8 mm wide, the lateral sepals 1.4 cm along the column foot. Petals acuminate, abruptly narrowed below the middle, about 4 cm long and 6 mm wide. Lip obovate, 1.8 cm long and 1 cm wide, 3-lobate on the apical quarter, the apex thickened; callus sparsely pilose, ligulate, thickened and raised in front, to just above the lower ½ of the lip. Column arcuate, 9 mm long from the receptacle and passing into a laterally and shallowly sigmoid foot 12-14 mm long; pollinia 4, supported on a saddle-shaped viscidium.

Very little known; cloud forests at 400–1400 m. Flowering August to October and March. Costa Rica and Panama.

This species is most similar to *M. chionantha*, *M. pachyacron*, and *M. reichenheimiana*, but the leaves are unspotted, the callus reaches to just above middle of the lip, the sepals and petals are more acuminate, the tips are often spiraled or pendent, and the column foot is extremely pronounced and somewhat sigmoid.

Maxillaria attenuata Ames & C. Schweinf., Sched. Orch. 10:89–90. 1930. TYPE: Costa Rica, La Palma, *Brenes* 512 (holotype: AMES; isotype: NY). Figure 23B.

Plant a small, cespitose epiphyte usually forming small clumps. Roots white, to about 0.75 mm in diameter. **Pseudobulbs** ovoid, to about 1 cm long, partially concealed at the base by 1–2 foliate sheaths, 1-foliate

apically. Leaves petiolate; petiole to about ¼ the length of the blade and narrowed above the articulation of foliate sheaths; blade elliptic, about 2-7 cm long, 5-10 mm wide, acute. Inflorescence apparently single per leaf axil; peduncle 4-7 cm long; somewhat scurfy ovary with pedicel about 1.7-1.9 cm long at anthesis, subtended by a somewhat shorter, obtuse floral bract. Flowers not opening widely, brick red or greenish-stained with maroon. Sepals lanceolate-attenuate, acute; dorsal concave at the base, 1.6-2 cm long, 3.5-4 mm wide; lateral sepals somewhat falcate, 1.8-2.2 cm long, 5 mm wide. Petals lanceolate, falcate, attenuate, 1.4-1.7 cm long, 2.5 mm wide, acute. Lip elliptic to rhombic, attenuate, obscurely 3-lobate at about the middle, 1.4–1.5 cm long, 5-6 mm wide when spread, the apex acute and keeled; callus simple, ligulate, rounded and thickened in front, terminating at or below the middle. Column stout, about 4.5-5 mm long without the anther; foot about 5 mm long. Capsule more than 3 cm long.

Epiphytic in wet, premontane rain forests at 1000–1300 m, often partially concealed by the thick mats of epiphytic mosses in which it grows. Flowering August to December. Costa Rica; also reported from South America.

Maxillaria attenuata is recorded from Venezuela and Bolivia and may be conspecific with the earlier name M. guadalupensis Cogn. as accepted by Garay and Dunsterville (Venez. Orch. Ill. 6: 250). A Bolivian plant illustrated as M. attenuata (Icones Plantarum Tropicarum, Series II, Plate 251. 1989) is probably the same species, but the lip has a proportionately longer midlobe. Plants from Venezuela are recorded from 2285 m.

Maxillaria bicallosa (Rchb. f.) Garay, Caldasia 8:527. 1962. *Zygopetalum bicallosum* Rchb. f., Otia Bot. Hamb. 1:9. 1878. TYPE: Ecuador, near Guayaquil, Lehmann (holotype: w). *Kefersteinia bicallosa* (Rchb. f.) Rchb. f. Otia Bot. Hamb. 1:31. 1878. Figure 18D.

Plant epiphytic, cespitose, psygmoid, 20–40 cm tall. Roots filiform, to 1.5 mm in diameter. Leaves equitant, with unspotted, papery-margined sheaths 3-6 cm long at the base; blade thin, spreading, linear-oblanceolate, to 45 cm long, 7-13 mm wide. Inflorescences 2 or more within each leaf axil; scapes 2-4 cm long; pedicellate ovaries (1?)2.5-3 cm long, much exceeding the subtending acute bract. Flowers wine red. Sepals similar, elliptic lanceolate, 9-10 mm long, 2.5-3 mm wide, acute. Petals elliptic, about 8 mm long, 2 mm wide, acute. Lip narrowly ovate, slightly constricted above the middle, 8-9 mm long, 3-4 mm wide, with rounded apex; with ligulate callus from the base to about 3/3 the lip, apex rounded to somewhat 2-lobate. Column cylindric, about 5.5 mm long excluding the anther (1 mm long); foot nearly obsolete. Capsule linear, about 2.5 cm long.

Epiphytic in cloud forests at 1100–1200 m. Flowering September and October. Costa Rica (southern) and Panama; also western Ecuador (600 m).

Maxillaria bicallosa is most closely related to M. chartacifolia Ames & C. Schweinf. but differs in its narrower leaves, which lack spots at the base and have much shorter scapes and wine-red flowers. The type sheet at Vienna shows broader leaves than those from Costa Rica.

Maxillaria biolleyi (Schltr.) L. O. Williams., Ann. Missouri Bot. Gard. 28:425. 1941. *Ornithidium biolleyi* Schltr., Repert. Spec. Nov. Regni Veg. 9:29–30. 1910. TYPE: Costa Rica, near San José, *Biolley 1052* (drawing of type: AMES). *Camaridium biolleyi* (Schltr.) Schltr., Beih. Bot. Centralbl. 36:498. 1918. Figure 5A.

Plant an erect to pendent epiphyte lacking pseudobulbs (juveniles?); mature stems apparently monopodial, rather thick and concealed by imbricate leaf sheaths. Roots to about 1 mm in diameter. Leaves conduplicate, lacking distinct petioles, deciduous, especially on the lower stem; blades above the articulation 5–28 cm long, 1.5-3.2 cm wide, obtuse and unequally 2-lobate. Inflorescences 2-many per leaf axil, shorter than the sub-tending leaf; scape 5-7 cm long; ovary with pedicel 6-7 mm long, subtended by a somewhat membranaceous floral bract about 1.1 cm long. Flowers white or pinkish with pink or salmon lip. Sepals similar, oblong-lanceolate, 1.3-1.5 cm long, 3-3.5 mm wide, acute. Petals elliptic-lanceolate, 1.1-1.2 cm long, 2.5-3 mm wide, acute to attenuate. Lip somewhat flexible with the column foot, 3-lobate below the middle, about 5 mm long and 5 mm across when spread; lateral lobes basal and erect around the column, rounded; midlobe biblike, rounded to emarginate; callus between the lateral lobes, simple, raised, heart-shaped. Column stout, 1.5-2 mm long without the anther; foot less than 1 mm long.

Epiphytic and terrestrial at 1600-2200 m. Flowering October to February. Costa Rica and Panama

Maxillaria biolleyi has long been confused with M. adolphii (Schltr.) Ames & Correll, M. falcata Ames & Correll, and M. quadrata Ames & Correll, but the smaller flowers on long scapes and the relatively simple lip with heart-shaped callus distinguish it from these.

Maxillaria brachybulbon Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:55. 1923. TYPE: Costa Rica, San Jeronimo, *Wercklé 23* (drawing of type: AMES). Figure 25A.

Plant a small cespitose epiphyte 4–8 cm tall. Roots white, to about 0.75 mm in diameter. **Pseudobulbs** minute, compressed, about 0.5 cm tall, apically 1-foliate,

and subtended by usually 2 leaf-bearing sheaths. Leaves oblong-oblanceolate, shortly petiolate, and obtuse, 2–8 cm long and 0.4–0.8 cm wide. **Inflorescence** apparently arising on immature growth only, the scapes single per rhizome bract, covered by up to 4 tubular, chartaceous sheaths; ovary with pedicel shorter than the floral bract, 1.1-1.6 cm long. Flowers pale yellow or greenish, sometimes striped with purple, the lip basally lined with purple and the midlobe yellow. Sepals similar, acute; dorsal elliptic, 1.4-1.6 cm long, 3-4 mm wide; lateral sepals oblong-lanceolate, 1.6-2 cm long, 3-4 mm wide. Petals narrowly elliptic, 1.5 cm long, 2.5 mm wide, acute. Lip hinged to the column foot, about 1 cm long, the midlobe fleshy and 3.3 mm long; callus ligulate on lower 3/3, parabolic and thickened apically. Column cylindric, flattened beneath, 7 mm long including the foot (2 mm long); anther cap 1.5 mm long; pollinia 4, lacking a stipe but supported on a saddle-shaped viscidium. Capsule ellipsoid, about 2 cm long.

Apparently rare epiphyte in rain forests at 50–1000 m. Flowering throughout the year. Honduras to Panama; also reported from Venezuela and Brazil.

This species has been recognized by authors as the South American *M. xylobiiflora* Schltr., a somewhat larger species with linear leaves. *Maxillaria brachybulbon* has a generally larger flower and a proportionately longer midlobe than does the closely related *M. pterocarpa* Barb. Rodr., often misidentified as *M. brachybulbon*.

Maxillaria bracteata (Schltr.) Ames & Correll, Bot. Mus. Leafl. 11:14, 1943. *Ornithidium bracteatum* Schltr., Repert. Spec. Nov. Regni Veg. 9:217–218. 1911. TYPE: Costa Rica, La Palma, *Tonduz 12344* (lectotype: US). *Camaridium bracteatum* (Schltr.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:57. 1923. *Maxillaria vagans* Ames & C. Schweinf., Sched. Orch. 8: 65–66. 1925. TYPE: Panama, Chiriquí, *Powell 348* (holotype: AMES). Figure 16C.

Plant a somewhat ascending, cane-forming epiphyte to about 50 cm tall comprised of shoots 3-15 cm long, each terminated by a pseudobulb. Roots white, to about 1 mm in diameter. Pseudobulbs parallel with the continuing rhizome, fusiform to conic, compressed, 1-foliate, 2.5-5(7) cm long, 1-2(4) cm wide, subtended by 1-4 strongly rugose sheaths with soon deciduous blades. Leaf blades shortly petiolate, chartaceous, linear-oblong, 3-20 cm long, 1-3 cm wide, the apex unequally 2-lobate. Inflorescences 1-3 per foliaceous sheath axil, 3-8 cm long; ovary with pedicel 8-12 mm long. Flowers with somewhat spreading segments, white to pale yellow with red or pink marks, especially the lip. Sepals similar, oblong to oblanceolate, 1.7-2.2 cm long, 5-6 mm wide, acute; dorsal somewhat keeled dorsally and apically. Petals oblong-oblanceolate, 1.5–1.7 cm long, about 4 mm wide, acute. Lip ovate in general outline, 3-lobate

below the middle, 1.1–1.2 cm long, 6–7 mm wide when spread; lateral lobes rounded, somewhat erect and embracing the column; midlobe fleshy, rounded, abaxially keeled; callus fleshy, truncate in front at about the same level as the divergence of the lateral lobes, with a blunt central keel. **Column** stout, arcuate, 4–5 mm long excluding the anther; foot about 2 mm long.

Common epiphyte of larger branches at 1300–2700 m. Flowering throughout the year. Costa Rica and Panama.

Maxillaria bracteata is often seen on forest remnants in pastures. In Costa Rica it is most similar to M. gomeziana J. T. Atwood, a species with trigonous ovaries and statistically narrower leaves. It strongly resembles M. imbricata Lindl. from South America, but none of the available illustrations of that species show the blunt keel of the callus. For the moment these are best kept separate.

This has long been known by the later synonym, *M. vagans* Ames & C. Schweinf. The appearance of an isotype of *M. bracteata* (US) consistent with Schlechter's original description shows that this name has been badly misapplied to other species (see Atwood, Lindleyana 9:239–242, 1994).

Maxillaria bradeorum (Schltr.) L. O. Williams, Ann. Missouri Bot. Gard. 28:425. 1941. Camaridium bradeorum Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:141–143. 1923. TYPE: Costa Rica (photo of type: AMES). Maxillaria semiorbicularis Ames & C. Schweinf., Sched. Orch. 8:64–65. 1925. TYPE: Costa Rica, Province of San José, La Hondura, Standley 36247 (holotype: AMES). Figure 14D.

Plant a straggly terrestrial or epiphyte to at least 1.5 m long forming erect to decumbent canes comprised of successively borne shoots, each shoot terminated by a pseudobulb. Roots forming only on the lowest shoots, to 2 mm in diameter. Pseudobulbs ovoid to suborbicular, compressed, to about 5 cm long; base subtended by several leaves; apex 1(-2?)-foliate. Leaves distinctly and shortly petiolate, conduplicate; blade narrowly elliptic, increasing in size toward apex within each shoot, to about 20 cm long, 4.5 cm wide, acute. Inflorescence 1 per bract axil, subtended by a foliaceous bract with distinct articulation; scapes sheathed in acute bracts, to about 7 cm long; ovary with pedicel (1)1.2-1.7(2.2) cm long, exceeded by the subtending floral bract. Flowers variable in color, white to light yellow, the tepals stained with pink to lavender apically or spotted; lip yellow and with reddish transverse bars. Sepals oblong to lanceolate; dorsal 2.2-3.1 cm long, 8-9 mm wide; lateral sepals somewhat oblique 2.1-3.2 cm long, 8-10 mm wide, acute. Petals elliptic-lanceolate, 1.9-3 cm long, 7-10 mm wide; apical margins somewhat involute; apex acute

to attenuate. Lip hinged to the column foot, 3-lobate, when spread 7–9 mm long, 1–1.3 cm wide; lateral lobes clasping the column, the outer margin rounded, acute, the midlobe subtriangular with acuminate apex; callus a raised ligule ending below the sinuses of the lobes, 3-dentate in front, papillose on the lower ½. Column arcuate, 8–10 mm long excluding the anther; foot (2.5)3–4 mm long; anther about 2 mm in diameter.

Epiphytic and terrestrial in premontane and lower montane rain forests at 700–1800 m. Flowering at least July to November, January, and March. Costa Rica and Panama.

Maxillaria bradeorum is closely related to sympatric M. ampliflora C. Schweinf. but has consistently smaller flowers, usually with more pink or lavender. The lateral lobes of the lip are proportionately longer and more acute than in M. ampliflora.

Apparently Schlechter's type had a pair of leaves at the pseudobulb apex, a feature not otherwise seen among plants interpreted here as M. bradeorum. The extant type drawings at AMES of Camaridium bradeorum showing the lip with smaller, more acuminate midlobe nicely distinguish this species from M. ampliflora C. Schweinf. Ames and Schweinfurth argue in their original description that their M. semiorbicularis differs from C. bradeorum by the "smaller leaves, monophyllous pseudobulbs, and different midlobe." However, leaf size is generally extremely variable in Maxillaria, and Schlechter appears to have had an oddity in the 2-foliate pseudobulbs. There is nothing in the original description of M. semiorbicularis to support differences in the midlobe of the lip with that of M. bradeorum.

Maxillaria brevilabia Ames & Correll, Bot. Mus. Leafl. 11:15, fig. 1. 1943. *Ornithidium alfaroi* Ames & C. Schweinf., Sched. Orch. 10:98. 1930. TYPE: Costa Rica, La Fuente, *Alfaro* 227 (holotype: AMES). Not *Maxillaria alfaroi* Ames & C. Schweinf., Sched. Orch. 10:83–84. 1930. Figure 9B.

Plant a somewhat creeping or lax cane-forming epiphyte to 50 cm tall; shoots forming an elongate scale-covered rhizome to 7 mm in diameter. Roots to 1 mm in diameter. Pseudobulbs ancipitous, elliptic-cylindric, 3–6 cm long, 1–3 cm broad, spaced 2–5 cm apart, sheathed at the base when young by a pair of enlarged nonfoliaceous bracts, apically 1-foliate. Leaf shortly petiolate; blade chartaceous in dried specimens, narrowly elliptic, 4–17.5 cm long, 1.3–3.5 cm wide, obtuse or rounded, rarely bluntly acute. Inflorescences developed along the entire mature rhizome and usually densely so; scapes less than 5 mm long, hidden by the rhizome

scales; ovary with pedicel 3–3.5 mm long concealed by inflated scape bracts. Flower white sometimes with pink or maroon flush at base of the segments, the lip orange-yellow. Sepals ovate-lanceolate; dorsal 6.5–8 mm long, about 2.5–3 mm wide; lateral sepals about ½ connate, 8–9.5 mm long. Petals oblong, 5.5–6.5 mm long, 1.5–2 mm wide, subacute. Lip subovate when spread, 5–5.5 mm long, 3.5–4.5 mm wide, forming an acute angle with the column foot, the apical third 3-lobate; lateral lobes broadly rounded; midlobe triangular-ovate; callus fleshy, transverse across the base of midlobe. Column stout, about 2 mm long excluding the anther; foot about 2 mm long.

Epiphytic in montane rain forests, often in association with oaks, Lauraceae and *Chusquea*, at 1000–2350 m. Flowering mostly August to January. Costa Rica (Volcán Poás) to Panama (Boquete).

Maxillaria brevilabia is easily distinguished from other members of the M. neglecta (Schltr.) L. O. Williams complex by the relatively large, cylindric pseudobulbs and broadly elliptic leaves. Inflorescences develop along the entire length of the most recently matured rhizome segment, and the lip forms a sharp angle with the column foot, unlike related species.

Maxillaria brunnea Linden & Rchb. f., Bonplandia 2:281. 1854. TYPE: Colombia, Ocaña, Schlim 1161 (holotype: w). ?Maxillaria porrecta Lindl., Bot. Reg. 24: misc. 92. 1838. TYPE: Brazil(?), "Rio Janeiro," Loddiges s.n. (holotype: к). Maxillaria trinitatis Ames, Sched. Orch. 2:34–35. 1923. TYPE: Trinidad, British West Indies, heights of Aripo, W. E. Broadway 9890 (holotype: AMES). Maxillaria brenesii Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 56, 231–232. 1923. TYPE: Costa Rica, San Pedro de San Ramón, Brenes 78 (lectotype: CR; isolectotype: AMES). Figure 21A.

Plant a densely cespitose epiphyte sometimes producing large clumps. Roots white, to about 1 mm in diameter. Pseudobulbs ovoid, little compressed laterally, 2.5-6 cm long, subtended by short, spotted, acute sheaths; apex 1-foliate. Leaves distinctly petiolate; petiole 1-20 cm long; blade narrowly elliptic, usually glaucous beneath, 16-34 cm long, 2-5.5 cm wide, acute. Inflorescences appearing in the bract axils of the recently completed shoot; scapes 8-17 cm long, concealed by 5-8 bracts of about the same length or increasing gradually; ovary with pedicel 1.8-3.7 cm long. Flowers creamy yellow flushed with rose, the lip apex purple beneath. Sepals rather dissimilar, somewhat concave; dorsal ligulate, 2.1-3 cm long, 5-6 mm wide, acute; lateral sepals lanceolate-ligulate, oblique, 2.2-3.1 cm long, 5-6 mm wide, acute to obtuse. Petals falcate-ligulate, 2-2.5 cm long, 3-4 mm wide, acute. Lip generally

obovate when spread, 1.4–1.7 cm long, 7.5–10 mm wide, 3-lobate on the apical ½–¼; side lobes with margins embracing the column, rounded to truncate; midlobe suborbicular, thickened centrally, the margins crenulate; callus sparsely pubescent, ligulate, thickened and somewhat V-shaped apically. Column stout, 7–9 mm long excluding the anther; foot about 5 mm long; anther about 3 mm in diameter. Capsule ellipsoid, 5–6 cm long.

Locally common and widespread epiphyte on large branches in rain or cloud forests at (300)600–1800 m. Flowering June to March. Nicaragua (expected in Honduras) to Colombia and Trinidad.

Maxillaria brunnea as accepted here may represent more than one species in Costa Rica, one with yellowish flowers with larger bracts (perhaps M. powellii Schltr., described from central Panama), the other with much more reddish flowers with smaller bracts and shorter, more abrupt midlobe (M. brenesii Schltr.). As interpreted for this treatment, M. brunnea is characterized by the cespitose habit, single leaf at the pseudobulb apex, the creamy yellow to whitish flowers sometimes tinged with red on the sepals, and dark red abaxial side to the lip apex. Its close relative, M. longiloba, has a fleshier and proportionately longer midlobe that is usually sharply reflexed. Specimens from lower elevation are usually smaller, with flowers less tinged with red. Flowers of related M. ringens Rchb. f. have longer and proportionally narrower sepals colored white to yellow with the lip much shorter than ½ the lateral sepals, while the lip of M. brunnea exceeds ½.

The earliest name for members of the *M. brunnea* complex may be *M. porrecta* Lindl. (G. Carnevali, pers. comm.), an entity based presumably on Brazilian material. Neither Ames nor Schlechter compared their new species with *M. brunnea* or *M. porrecta*.

Maxillaria burgeri J. T. Atwood, Lindleyana 9: 233–236. 1994. TYPE: Costa Rica, Province of Heredia, southern slope of Volcán Barba at 2200 m, W. C. Burger & R. G. Stolze 6062 (holotype: F; isotype: MO). Figure 12C.

Plant an erect (when young), pendent, or decumbent, much branched, cane-forming epiphyte to about 30 cm tall, rooted only on the lower shoots; pseudobulbs to about 5 cm apart on lower but closer in successive shoots. Roots less than 1 mm in diameter. Pseudobulbs suborbicular to obovoid, 7–12 mm long, 4–9 mm wide often subtended when young by a foliaceous sheath, the apex 1-foliate. Leaves and foliaceous sheaths similar; apical leaf with short petiole; blades thin, elliptic-ob-

long, rounded to emarginate, 1.5-9 cm long, 3-8 mm wide, abaxially keeled. **Inflorescence** single per rhizome bract of both mature and immature shoots, less than 1 cm long; ovary with pedicel 5-7 mm long, exceeded by the subtending, acute, floral bract. Flowers not opening widely, with lateral sepals and petals recurved, yellow; lip yellow or with purple-red callus; column white. Sepals subequal, elliptic-lanceolate, 10-13 mm long, 2-2.5 mm wide, acute; dorsal somewhat concave; lateral sepals subfalcate. Petals elliptic-lanceolate, falcate, acute, 9-12 mm long, 2.25-2.75 mm wide. Lip hinged with the column foot, convex, recurved in natural position, ovate when spread, 4-5 mm long, about 3 mm wide, 3-lobate on the lower 1/4; lateral lobes shorter than the callus; midlobe ovate, reflexed at the base, obtuse or rounded to emarginate; callus fleshy, rounded, and somewhat elevated in front, terminating below the middle. Column stout, arcuate, somewhat tapering, 2-3 mm long excluding the anther; foot about 1 mm long.

Poorly known epiphyte of montane rain forests at 1100–2500 m. Flowers May and June. Endemic to Costa Rica.

Maxillaria burgeri is at once distinguished from M. flava and M. microphyton by the suborbicular to ovoid pseudobulbs, which usually lack a subtending foliaceous bract. Specimens have been identified as M. microphyton, but the lip with large midlobe is more similar to that of M. flava.

Maxillaria caespitifica Rchb. f., Linnaea 41:73. 1877. TYPE: Costa Rica, *Endres* (holotype: w). Figure 25D.

Plant a cespitose to shortly rhizomatous epiphyte to about 15 cm high. Roots to about 1 mm in diameter. Pseudobulbs fusiform to cylindric, subtended by nonfoliaceous sheaths, apically 1-foliate, 1.5-2.5 cm long. Leaves thin, usually shortly petiolate, the blade lanceolate, to about 10 cm long, the apex unequally 2-lobate. Inflorescences formed in the flush of new growth, to about 2 cm long. Flowers yellow or greenish yellow, the lip with red callus. Sepals similar, oblong, 5-7 mm long, about 4 mm wide, acute to obtuse; dorsal concave; lateral sepals slightly falcate. Petals oblong, 5-6 mm long, about 3 mm wide; apex acute and recurved. Lip simple to lightly 3-lobate, more or less straight with the sides somewhat embracing the column, elliptic-ovate, 5-6 mm long, about 3 mm wide, the apex truncate to rounded or retuse; callus a fleshy and shiny ligule on the lower ½. Column arcuate, 5-6 mm long excluding the anther; foot about 1 mm long.

Epiphytic but very poorly known; probably from 100 to 1200 m as in Nicaragua. Costa Rica and Nicaragua, possibly Honduras, and reported from South America. Flowering in Costa Rica unknown; January in Nicaragua. The above description is based in part on that by Hamer (Icon. Pl. Trop. 9: pl. 845).

Some authors include this species as a synonym of *M. variabilis* Bateman ex Lindl., but the more cespitose plant and much smaller, usually greenish flower of *M. caespitifica* are rather easy features to recognize in live plants.

Maxillaria camaridii Rchb. f., Hamburger Garten-Blumenzeitung 19:547. 1863. Basionym: Camaridium ochroleucum Lindl., Bot. Reg. 10: t. 844. 1824. TYPE: Trinidad, Woodford. Cymbidium ochroleucum Lindl., Gen. Sp. Orch. Pl. 168. 1833. Camaridium affine Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:72–73. 1922. TYPE: Panama, on hills near Panama City, Powell 7 (isotype: AMES). Not Maxillaria ochroleucum Lodd. ex Lindl.

Plant a straggly, usually decumbent or pendent epiphyte. Stems elongate, the rhizome 2-15 cm between pseudobulbs. Roots less than 1 mm in diameter. Pseudobulbs elliptic-ovate, strongly compressed laterally, 2.5-5.5 cm long, 1.5-3 cm wide; base concealed by several soon-deciduous, foliaceous sheaths; apex 1-2-foliate. Leaves short-oblong to long-linear, short-petiolate or not, the blades rarely to 33 cm long, 8–18 mm wide. **Inflorescence** 1 (or more?) per foliaceous bract; scapes to about 5 cm long, mostly included within the rhizome bract; scape bracts acute; ovary with pedicel 1.6 cm long. Flowers ephemeral, lasting about a day, white; lip yellow with red or purple bars on lower half and at base of column. Sepals dissimilar, elliptic, acute; dorsal somewhat concave, 3.2 cm long, 1.2 cm wide; lateral sepals 3.1 cm long, 1.2 cm wide. Petals elliptic-oblong, somewhat falcate, 2.9 cm long, 8.5 mm wide, acute. Lip strongly attached to but well distinguished from the column foot, 3-lobate on about the apical \(^3\), 1.4 cm long, 1.3 cm wide when flattened; lateral lobes rounded; midlobe rounded in front; callus with rusty hairs on the lower half, the front part broken up into papillae. Column cylindric, arcuate, about 1 cm long excluding anther; foot about 2 mm long. Capsule ellipsoid, about 3 cm long.

Epiphytic in lowland tropical forests at 0–250 m. Flowering August to November. Most of tropical America north and west to at least Central Panama; reported from Guatemala.

It is distinguished by the canes with pseudobulbs and white, short-lived, fragrant flowers with yellow lip marked with red. The rare *M. suaveolens* Barringer is similar but is a much larger plant with proportionately larger flowers. No specimens of *M. camaridii* have been seen to confirm reports from Costa Rica, but it may occur there.

Maxillaria campanulata C. Schweinf., Bot. Mus. Leafl. 5:94–95. 1938. TYPE: Costa Rica, *Jiménez 315* (holotype: AMES). Figure 15B.

Plant a large rhizomatous epiphyte with several branching stems all rooted at the base, each to about 1.5 m long, comprised of successively borne shoots with each terminated by a pseudobulb. Roots to about 1 mm in diameter. Pseudobulbs ovoid, compressed, to about 40 cm apart, to 10 cm long and 5 cm wide, mostly concealed by several foliaceous bracts, the apex 1-foliate. Leaves coriaceous, keeled abaxially, articulate, petiolate; blades oblong to linear or narrowly elliptic, to 25 cm long, 3.8 cm wide, with sheath blades relatively shortly petiolate, the apical leaf with much more slender petiole, the apex acute to obtuse and mucronate. Inflorescence 1 per foliaceous bract axil of the developing shoot; scape to about 10 cm long, longer than the subtending leaf, concealed by acute bracts; ovary with pedicel 1.5-1.8 cm long exceeded by the subtending acute floral bract. Flowers campanulate, somewhat nodding with recurved sepals and petals, greenish yellow conspicuously marked transversely with brick red bars. Sepals oblong or oblanceolate; dorsal about 2.2 cm long, acute; lateral sepals 2.3-2.5 cm long, attenuate. Petals oblong, 1.9-2.1 cm long, 7-8 mm wide, apex bluntly acute to obtuse. Lip hinged to the column foot, obovate when spread, 9-10 mm long, 7-8 mm wide, 3-lobate on the upper 1/5, the sides embracing the column; lateral lobes obtuse; midlobe fleshy, suborbicular, obtuse; callus a truncate or emarginate ligule ending above the middle, extending toward the base where 3 or more low, warty keels are located. Column stout, nearly straight, 7-8 mm long excluding the anther; foot 1.5-2 mm long. Capsule about 2.5 cm long.

Epiphytic in evergreen forests at 400–1500 m. Conceivably the upper vertical distribution reflects locally warmer microclimates of pastures. Flowering at least August to December. Endemic to Costa Rica.

Maxillaria campanulata belongs to a group of species characterized by the half-lyre-shaped foliaceous bracts subtending the inflorescences, a group that includes M. ampliflora, M. bradeorum, and M. umbratilis. This species usually masquerades as M. bradeorum, but the sepals and petals are recurved, the lip is narrower than long when spread, and the callus lacks the shaggy pubescence at the base.

Maxillaria cedralensis J. T. Atwood & D. E. Mora, Selbyana 18:31–32. 1997. TYPE: Costa Rica, Province of San José, Cedral, 2000 m, Apr. 1990, D. E. Mora B-35 (holotype: USJ). Figure 22D.

Plant cespitose forming large clumps, to 30 cm tall. Stems approximate, roots to 1 mm in diameter. Pseudobulbs ovate, compressed, 5–7 cm long, 2.5–4 cm wide, subtended by inarticulate, triangular, nonfoliaceous bracts; apex 1-foliate. Leaf narrowly elliptic, to 45 cm long, 2.5–4 cm wide, apex bluntly acute. Inflorescence 8–10 cm, slightly fractiflex, concealed by bracts; ovary with pedicel 1.5–2 cm long, exceeded by the acute, cucullate, floral bract. Flowers creamy white,

the petals spotted with maroon near the base of the tepals; lip cream, spotted with maroon; column spotted with maroon on ventral side. **Sepals** elliptic, acute, with revolute margins, 3.5 cm long, 1.3 cm wide. **Petals** elliptic-lanceolate, acute, about 3 cm long, 0.9 cm wide, the margins revolute. **Lip** 3-lobate, 1.5 cm long, 0.8 cm wide when spread; lateral lobes embracing the column, truncate to somewhat emarginate apically; midlobe about ½ lip length, recurved; callus 2-keeled, canaliculate, exceeding the lateral lobes in front. **Column** arcuate, 1.25 cm long including the anther; foot very short; pollinia 4, supported on a short stipe and viscidium.

Ecology poorly known, apparently epiphytic at about 2000 m. Flowering at least March. Endemic to Costa Rica, where it is known only from Cedral de Aserrí.

Maxillaria cedralensis is unique in the M. cu-cullata complex with its large leaves, cream-colored flowers, and spotted lip with rather narrow midlobe. Maxillaria cedralensis differs from related M. punctostriata Rchb. f. and M. obscura Lind. & Rchb. f. in its sepals with revolute margins.

Maxillaria chartacifolia Ames & C. Schweinf., Sched. Orch. 10:92. 1930. TYPE: Costa Rica, Guanacaste, La Tejona, north of Tilarán, *Stand-ley & Valerio 45989* (holotype: AMES). Figure 18C.

Plant a psygmoid, large clumping, cespitose epiphyte to about 40 cm tall, the shoots approximate. Roots to 1.5 mm in diameter. Pseudobulbs absent, obsolete, or at least concealed by leafy rhizome bracts. Leaves 5 or more per shoot at anthesis, distichous, with long sheaths and petioles, the sheaths strongly conduplicate, spotted, 5-12 cm long and 1.2-2.5 cm from margin to midvein, petiole narrowed just above the articulation, strongly conduplicate, the blade 12-55 cm long and 1.7-4 cm wide, the midvein sulcate above and keeled beneath. Inflorescence a fascicle of several usually successively borne single-flowered scapes per rhizome bract axil, 7-13 cm long, concealed by 4-6 acute, scape bracts 1.5-3 cm long; ovary with pedicel 3-4 cm long, much exceeding the subtending bract. Flowers short lived, with putrid odor similar to that of strong cheese, yellow at anthesis, aging brownish red. Sepals lance-oblong, 1.8-2.2 cm long, 6-8 mm wide, acute. Petals elliptic-oblanceolate, 1.3-1.4 cm long, 4.5-5.5 mm wide, acute. Lip hinged to the column foot, rhombic-ovate, obscurely 3lobulate, 1.3-1.4 cm long, 5.5-6.5 mm wide; callus fleshy, extending from the base to apex, with an additional ovate, hard callus superposed at the middle. Column arcuate, broadened above, 8 mm long; foot 3-4 mm long, the anther cap 2.5 mm long. Capsule linear, 5-6 cm long, expanding into 6 valves and remaining united at the apex.

A large clumping epiphyte of wet forests at 500-1700 m. Flowering September to November,

May, and to be expected throughout the year. Costa Rica to Ecuador.

This species and the closely related *M. bicallosa* (Rchb. f.) Garay have a psygmoid (fanlike) habit with at least 5 thin chartaceous leaves. *Maxillaria bicallosa* has much narrower leaves (rarely exceeding 1.2 cm) than *M. chartacifolia*, and its sheaths are unspotted.

Maxillaria chionantha J. T. Atwood, Selbyana 16:242. 1995. TYPE: Panama, Province of Veraguas, vicinity of Continental Divide, third branch of Río Santa María to drop-off to low-lands, R. L. Dressler 4839 (holotype: SEL). Figure 24D.

Plant epiphytic, cespitose, sometimes densely so, 10-30 cm high. Roots slender, to 1 mm in diameter. Pseudobulbs ovoid, compressed, 2-3 cm long, usually concealed by 1-3 subtending, foliaceous, and long petiolate sheaths. Leaves long petiolate; petiole ¼-½ the blade, abruptly narrowed above the articulation; blade elliptic, usually broadly so, 5-13 cm long, 2-5 cm wide, acute and apiculate. Inflorescence 1 per rhizome bract; scape 3.5-8 cm long, concealed by acute scape bracts; ovary 1-2.2 cm long, somewhat warty, subtended, and much exceeded by a cucullate, acute, floral bract. Flowers campanulate, white aging tan with ivory to light yellow lip. Sepals lanceolate, attenuate, 30-45 mm long, 6-8 mm wide, acute; laterals forming a chin 5-7 mm long. Petals lanceolate, attenuate, 25-40 mm long, 4-6 mm wide, acute. Lip oblong, simple to lightly 3-lobate on the upper \(\frac{1}{3} \), about 12 mm long, 5 mm wide when spread; lateral lobes slightly embracing the column; midlobe deltoid, verrucose, with recurved apex; callus a ligule from the base to above the middle, swollen in front. Column 7 mm long, 11 mm including foot; foot 4-5 mm long; anther 2 mm long, somewhat hidden from the broadened, dentate anther bed; pollinia 4, supported on a stipe and saddle-shaped viscidium. Capsule 4.5–6 cm

Epiphytic in premontane evergreen forests at 600-1000 m. Flowering August to February. Costa Rica and Panama.

Maxillaria chionantha closely resembles M. pachyacron Schltr., which has usually longer inflorescences, larger flowers with more attenuate segments, and a much more distinctly 3-lobate lip on the upper 1/6. Maxillaria pachyacron also has shorter pseudobulbs and grows at higher elevations. Maxillaria chionantha is also closely related to M. attenuata Ames & C. Schweinf., a species that also has distinctly petiolate leaves, attenuate floral segments, and a nearly simple lip, but is easily distinguished by the larger plant and larger and white flowers, rather than the red to maroon flowers of the latter species.

Maxillaria concavilabia Ames & Correll, Bot. Mus. Leafl. 11:15, fig. 2. 1943. *Ornithidium stenophyllum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:59. 1923. TYPE: Costa Rica, San Jeronimo, *Wercklé 109* (drawing of type: AMES). Not *Maxillaria stenophylla* Rchb. f. 1854. Not *Maxillaria stenophylla* F. Lehm. & Kraenzl. 1899. Figure 9E.

Straggly, rhizomatous epiphytes rooted only at the basal shoots; bract-covered rhizome elongate, to 4 mm in diameter. Roots fibrous, to 0.5 mm in diameter. Pseudobulbs cylindric to ovoid, somewhat compressed, 1foliate, (8)10-30 mm tall, 6-12 mm wide, spaced 1-5 cm apart, subtended and concealed when young by a pair of subulate bracts. Leaves shortly petiolate; blade lance-linear, strongly acute, 4-14 cm long, 7-15 mm wide. Inflorescence fascicled at the base of the pseudobulb, each scape less than 5 mm tall and concealed by the rhizome bracts; ovary 2-3 mm long. Flowers membranaceous, white or lip with yellow midlobe. Sepals dissimilar, not much spreading, apiculate; dorsal elliptic, (3?)6-7 mm long, 2 mm wide; lateral sepals oblong-ovate, 6-6.5 mm long, about 2.5 mm wide, about ½ connate. Petals linear, 4.5–6 mm long, about 1 mm wide, apiculate. Lip relatively fleshy, concave, 3-lobate, 2-2.5 mm long excluding the foot; lateral lobes suborbicular when viewed laterally; midlobe reflexed, bluntly acute; callus at the base apparently transverse connecting the lateral lobes. Column stout, 1-1.2 mm long excluding the anther, extended at the base into a foot about 1.5 mm long, strongly curved forward.

Epiphytic at 1400–2300 m, often in oak forests with *Chusquea* understories. Available specimens with flowers in good condition were all collected in August. Known only from Costa Rica from the Cordillera de Talamanca south of Cartago to the Panama border, but expected in Panama.

Maxillaria concavilabia has been confused with vegetatively similar M. neglecta (Schltr.) L. O. Williams, a low-elevation species with similar flower color. However, M. concavilabia has smaller flowers that are more membranaceous in dried specimens and therefore are difficult to rehydrate. The lip has pronounced rounded lateral lobes when viewed laterally, and the column foot is more antrorsely curved from the base. Similar M. parviflora (Poeppig & Endl.) Garay is a low-elevation species lacking the rounded lateral lobes.

Maxillaria conduplicata (Ames & C. Schweinf.)
L. O. Williams, Ann. Missouri Bot. Gard. 29:
348. 1942. Ornithidium conduplicatum Ames & C. Schweinf. Sched. Orch. 8:66–68. 1925.
TYPE: Panama, Chiriquí, Powell 341 (holotype: AMES). Figure 5D.

Plant poorly known, probably with canes to at least 50 cm tall. Canes mostly hidden from view by the somewhat inflated leaf sheaths (in dried material). Roots on canes to about 2 mm in diameter. Pseudobulbs apparently restricted to the base of the plant and formed only in the juvenile stage, ovoid, 5.5 cm long (n = 1), apically 1-foliate. Leaves congested or not (n = 2), the lower abscising early; sheaths rugose, somewhat inflated in the dried specimen; blade subcoriaceous, oblong, to 20 cm long and 2.7 cm wide, acute to obtuse or 2-lobate. Inflorescence a fascicle of several single-flowered scapes in leaf axils; scapes to 4 cm long, concealed by acute bracts; ovary with pedicel 8-9 mm long, subtended by a much shorter bract. Flowers globose, light yellow, with light pink on outside of sepals and petals; lip yellow. **Sepals** somewhat fleshy apically, similar, ovate, acute; dorsal somewhat concave, 5.9-6.5 mm long, 2.5-3 mm wide; lateral sepals about 7 mm long, 3 mm wide. Petals elliptic-ovate, acuminate, about 6 mm long, 2.5-3 mm wide. Lip somewhat hinged to the column foot, 4-lobate when spread, subquadrate, the basal lobes somewhat embracing the column and forming a shallow cup, the apical ½ somewhat conduplicate in front; callus at the base a simple thickening connecting the lateral lobes in front; also an apical, cushion-like callus in front. Column stout, about 1.5 mm long excluding the anther; foot about 1 mm long; anther about 1 mm long.

Maxillaria conduplicata is known from Panama and Costa Rica at 1200–1500 (3000) m. A live plant collected in a cloud forest at Cerro de la Muerte at about 3000 m survived two summers at Sarasota, Florida, where it flowered in November 1996. Based on this and two available herbarium specimens, it appears to flower from September to November. It may be much more common than available specimens would indicate, as the rather large plant with small, inconspicuous flowers probably does not catch the eye of collectors.

Maxillaria confusa Ames & C. Schweinf., Sched. Orch. 8:57–58. 1925. TYPE: Costa Rica, Peralta, *Lankester 908* (holotype: AMES). Figure 23C.

Epiphytes rarely forming large clumps. Roots to about 1 mm in diameter. Pseudobulbs apically 1-foliate, truncate, compressed, ovoid, 1–3 cm long, provided basally with 1–2 foliate bracts. Leaves petiolate, those subtending the pseudobulb constricted above the articulation; petioles to about ½ the blade length; blades ellipticoblanceolate, cuneate, 3–17 cm long, 1.3–3 cm wide, acute to obtuse. Inflorescences lateral, several per bract axil, each covered with 4–5 pale green bracts; scapes 3–7 cm long; ovary with pedicel 1.5–1.7 cm long. Flowers white to yellowish aging brownish, the lip with purple markings. Sepals dissimilar; dorsal elliptic-lanceolate, concave, 1.8–2.2 cm long and about 5 mm wide, the lateral sepals triangular-lanceolate, somewhat attenuate, 2–2.5 cm long and 5 mm wide at the base forming a

conspicuous, pointed chin. **Petals** lanceolate-falcate, 1.5–2 cm long and about 4 mm wide. **Lip** articulated with the column foot, obovate, cuneate, strongly 3-lobate on the apical $\frac{1}{2}$, 12–15 mm long and about 6 mm wide when spread; lateral lobes embracing the column; midlobe verrucose, suborbicular; callus ligulate, thickened and rounded in front, ending just above the middle, somewhat pubescent. **Column** stout, about 5 mm long excluding the anther; foot 6–9 mm long; anther roughpapillose, about 2 mm long, the anther bed conspicuously fringed; pollinia with short, squarrose stipe and horseshoe-shaped viscidium. **Capsule** about 4 cm long.

Rather common yet somewhat inconspicuous epiphyte of premontane rain forests at (150)500–1450 m. Flowering January to September, probably throughout the year. Belize to Panama.

Maxillaria confusa is similar to M. ramonensis Schltr. but has larger flowers with fringed anther bed.

Maxillaria costaricensis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:232–233. 1923. TYPE: Costa Rica, District of Volis in San Ramón, 1050 m, *Brenes 237* (lectotype: CR, not seen; isotypes: AMES, NY). Figure 11D.

Plant a somewhat straggly epiphyte to about 25 cm high, sometimes forming large clumps. Roots to about 1 mm in diameter. Pseudobulbs fusiform to cylindric; to 3 cm apart, subtended by nonfoliaceous sheaths, apically 1-foliate, 1.5-3 cm long, to 1 cm wide. Leaves thin, usually shortly petiolate, the blade linear-lanceo-late, 5–14 cm long, 5–9 mm wide, the apex obtuse to unequally 2-lobate. Inflorescence formed in the flush of new growth, to about 2 cm long; ovary with pedicel 1.5-2 cm long. Flowers green to cream or rose (old flowers?) tinted with red, the lip dark maroon. Sepals similar; dorsal concave oblong, 1-1.3 cm long, about 3-4 mm wide, acute to obtuse and apiculate; lateral sepals lanceolate to falcate, 1.1–1.4 cm long, 4–4.5 mm wide, acute. Petals oblanceolate, 1-1.2 cm long, about 3 mm wide, apex acute to obtuse and somewhat recurved. Lip simple to 3-lobate, more or less straight with the sides somewhat embracing the column, elliptic-ovate, 1-1.2 cm long, 4.5-5.5 mm wide; apex truncate to rounded; callus a fleshy and shiny ligule on the lower 1/2. Column arcuate, 7 mm long excluding the anther, the foot 2 mm long; anther about 2 mm in diameter. Capsule ellipsoid, about 1.5-2 cm long.

Epiphytic in rain and cloud forests at 500–1600 m. Flowering January to May and November. Endemic and apparently restricted to Costa Rica north of the Central Valley.

Maxillaria costaricensis is recognized by the rhizomatous habit, usually greenish flowers with pink or red stain, and maroon lip. Morphologically it is most similar to M. variabilis Bateman ex Lindl., but the leaves of M. costaricensis are

usually narrower, the flowers have a different color, and in areas of sympatry the plant grows in wetter zones. The petals of *M. variabilis* are more recurved apically. In dried plants the pseudobulbs of *M. costaricensis* tend to curl, while those of sympatric *M. variabilis* tend to remain stiff. However, in Panama, plants with flowers of *M. variabilis* are seen on plants similar to those of *M. costaricensis*. For the moment these are included in *M. variabilis*, but the name, *M. chiriquensis* Schltr., may be applicable should any segregates be recognized as distinct.

Maxillaria crassifolia (Lindl.) Rchb. f., Bonplandia 2:16. 1854. Heterotaxis crassifolia Lindl., Edwards's Bot. Reg. 12: t. 1028. 1826. ТҮРЕ: Jamaica, J. Lee (holotype: к). Dicrypta crassifolia (Lindl.) Lindl. ex Loud., Hort. Brit. Suppl. 3:536. 1839. Epidendrum sessile Sw., Prodr. Ind. Occ. 122. 1788. ТҮРЕ: Jamaica (holotype: ВМ, not seen). Maxillaria sessilis (Sw.) Fawc. & Rendle, Fl. Jamaica 1:120. 1910. Not Maxillaria sessilis Lindl. 1845. Dicrypta baueri Lindl., Gen. Sp. Orch. t. 44. 1830. ТҮРЕ: Jamaica. Figure 17B.

Plant a cespitose epiphyte, sometimes forming large clumps; pseudobulbs essentially obsolete. Roots to 2 mm in diameter. Leaves 4-5 per shoot, fleshy, shortly petiolate at the base, conduplicate, the blade linear to very narrowly elliptic, unequally bilobed at the apex, somewhat carinate abaxially and canaliculate adaxially on the midvein, 7-27 cm long, 1.3-3 cm wide, the adaxial surface appearing somewhat sunken along major veins. Inflorescences 1-few single-flowered scapes per leaf (rhizome bract) axil produced successively; ovary with pedicel about 1.5 cm long. Flowers barely emerging from the leaf axil, autogamous in some populations (Florida), white to yellow, the lip laterally stained or spotted with purple and with yellow callus. Sepals elliptic to ovate, thickened apically, 13-15(20?) mm long, 4-6 mm wide, acute. **Petals** oblanceolate to spatulate, 11-14 mm long, 3-4 mm wide, subobtuse. Lip articulate with the column foot, constricted below, the apical 1/3 appearing somewhat 3-lobate, the sides inflexed toward the column, 12–15 mm long, 5–6 mm wide; callus farinose (mealy), sticky, extending from the base to near the apex, linear, interrupted above the middle and broadened above. Column lightly arcuate, cylindric, broadened above, 9-10 mm long, forming a poorly defined foot 1-2 mm long.

An epiphyte of larger branches and trunks of trees in primary or secondary wet forests, rarely on rocks or embankments, at 5–1300 m. Flowering throughout the year. Widespread throughout the neotropics; Central America, tropical South America, Jamaica, Cuba, and south Florida.

This widespread, lowland species is easily distinguished by the fleshy, conspicuously veined leaves produced in fans and by the erect, upwardfacing flowers. Schlechter's *M. gatunensis* (Repert. Spec. Nov. Regni Veg. Beih. 17:68. 1922) is usually interpreted as a rather robust example from Panama with sepals 2 cm long, but the relatively short callus indicated in his floral diagnosis may be inaccurate. He probably did not observe the continuation of the callus to the lip apex, where it is less conspicuous in dried specimens.

Maxillaria cryptobulbon Carnevali & J. T. Atwood, Novon 1:159–162. 1991. TYPE: Ecuador, Morona-Santiago, Serranía de Cutucú, *Ackerman 1041*, based on *Madison s.n.* (holotype: SEL). Figure 20D.

Plant a cespitose epiphyte 30-50 cm tall. Roots to 1 mm in diameter. **Pseudobulbs** ellipsoid to suborbicular to oblong, somewhat depressed, 8-12 mm long, 9-15 mm wide, concealed by 2-3 subtending, broad sheaths, the uppermost of which may bear a blade, the apex 1foliate. Leaves long petiolate; petiole (4)8-15(24) cm long, ½-3/3 the blade length; blades broadly elliptic, somewhat decurved, (20)25–35(42) cm long, (2.3)4.5–7 cm wide, acute, the abaxial surface often glaucous. Inflorescences 1–3 per shoot, borne in the flush of new growth; scapes 5–10 cm long; ovary with pedicel 3–3.3 cm long mostly or entirely concealed by the floral bract. Flowers spreading; sepals dull red-brown to maroonred; petals pink or yellow-orange within, tinged with red-brown without; lip creamy yellow with yellow callus. Sepals similar, oblong to somewhat lanceolate, 2.6-2.8 cm long, 6-7.5 mm wide, the apex obtuse to rounded; dorsal concave; laterals somewhat oblique. Petals obliquely oblong-lanceolate to elliptic, 2.2–2.5 cm long, 5-6 mm wide, apex acute to obtuse. Lip sparsely pubescent within, ovate in general outline when spread, 1.6-1.8 cm long, 8-9 mm wide, base cuneate, 3-lobate in the apical 1/4; lateral lobes erect around the column with erose, rounded, or subtruncate apices; midlobe ovate, obtuse, thickened and fleshy, abaxially keeled, the margins thin and undulate; callus a thickened ligule, rounded in front just above the middle. Column arcuate, 7–8 mm long excluding the anther; foot 4–4.5 mm long; anther 2.5-3 mm long, keeled dorsally.

Epiphytic in premontane rain or cloud forests at 1200–1400 m. Flowering at least June and July. Costa Rica, Ecuador, and Venezuela (450 m).

The broad, long petiolate leaves and small, depressed pseudobulb distinguish the species. It is most similar to *M. brunnea* Lind. & Rchb. f. but has much broader leaves and smaller compressed pseudobulbs, and the flowers are stained with darker red.

Maxillaria ctenostachya Rchb. f., Gard. Chron. 39. 1870. Costa Rica, Veitch (holotype: w). Camaridium ctenostachys (Rchb. f.) Schltr.; Feddes Repert. Spec. Nov. Regni Veg. Beih. 19: 238. 1923. ?Camaridium arachnites Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:73–74. 1922. TYPE: Panama, Chiriquí, Powell 210 (isotypes (5 sheets): AMES). Figure 8B.

Plant a somewhat straggly, cane-forming epiphyte to about 1 m tall; shoots of each cane to 20 cm long, each terminated by a pseudobulb, diminishing in size in successive shoots. **Pseudobulbs** ovoid to conic, 1.5–10 cm long, subtended by 1 or more foliaceous sheaths; apex 2-foliate. Leaves linear-lanceolate, obtuse, to 25 cm long, 1–1.2 cm wide, apiculate. Inflorescences forming in the flush of immature growth, 1(-more?) per axil of the rhizome bracts; scape to about 3 cm long; ovary with pedicel about 5-7 mm long, subtended and exceeded by an attenuate bract 1.5–1.7 cm long. Flowers white, sometimes striped or suffused with purple, campanulate. Sepals similar, attenuate, more than 2 cm long, 3 mm wide. Petals similar to the sepals, attenuate, 1.7-2 cm (probably more) long, about 2.5 mm wide. Lip hinged to the column foot, ovate, about 7 mm long and 5 mm wide when spread, 3-lobate on the upper 1/3; lateral lobes obtuse and exceeding the callus; midlobe recurved, ovate; callus complex, consisting of 5 sharp keels from the base to about the middle, the outer of which terminate as sharp teeth, and a fleshy rounded callus near the divergence of the lateral lobes. Column 5-6 mm long excluding the anther; foot about 2 mm long.

Epiphytic in cloud forests at 900–1220 m. Flowering at least September and October. Costa Rica and Panama.

The spidery flowers borne on long canes with apically 2-foliate pseudobulbs are unique in Costa Rica. *Maxillaria ctenostachya* is poorly known and seldom collected.

Maxillaria dendrobioides (Schltr.) L. O. Williams, Ann. Missouri Bot. Gard. 27:283. 1940. Camaridium dendrobioides Schltr., Beih. Bot. Centralb. 36:415. 1918. TYPE: Costa Rica, San Ramón, 1500–1600 m, Tonduz 17620 (holotype: CR). Camaridium jimenezii Schltr., Beih. Bot. Centralb. 36:416. 1918. TYPE: Costa Rica, La Palma, Wercklé 855 (holotype: CR). ?Camaridium simile Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 239. 1923. TYPE: Costa Rica, San Ramón, 1025 m, Brenes (VII) 64 (isotype: NY). Figure 3C.

Plant a shrubby epiphyte to about 40 cm tall on usually large branches; rhizomes forming indeterminate canes, entirely concealed by sheaths, strict when small, decumbent when large; sometimes with a few branches diverging at acute angles with the main stem. Roots fibrous, white, mostly forming at the base of the plant and infrequently on the canes, rarely to 1 mm in diameter.

Pseudobulbs absent (juveniles?). Leaves densely distichous; sheath orangish to greenish and spotted with purple in dried material, with hyaline margins; blade coriaceous, 1–6 cm long, 5–10 mm wide, elliptic when short, lanceolate when long, the base clasping the stem, the apex unequally 2-lobate. Inflorescence single per leaf axil, mostly concealed by subulate bracts; scapes 1-2.5 cm long; ovary and pedicel 4-5 mm long, exceeded by the subtending floral bract. Flowers yellow to greenish, shading to red or salmon, the segments not spreading broadly. Sepals 8-13 mm long, 2-3.5 mm wide; dorsal elliptic-lanceolate, acute; lateral sepals falcate-lanceolate and acute. Petals elliptic to oblanceolate or obovate, 6.5-12 mm long, 2-3 mm wide, acute. Lip 3-lobate to broadly pandurate in outline, 4-7 mm long, 2.5-3 mm wide, obtuse; callus a fleshy ligule on the lower ½, truncate to rounded. Column 3-3.5 mm long excluding the anther; foot 1-2 mm long. Capsule globose, less than 1

Epiphytic and common on larger branches of trees in cloud forests at 800–2400 m. Often seen on remnants in pastures. Flowering year around. Costa Rica and western Panama.

As represented by the composite description above, *M. dendrobioides* is probably a complex of species. *Maxillaria dendrobioides* (sensu stricto) has a distinctly three-lobed lip with the midlobe more or less ligulate in shape. Plants with more or less pandurate lip, i.e., the base and apex each with a pair of angled lateral lobes and shorter leaves have been segregated as *Camaridium simile*. *Camaridium jimenezii* is supposed to have the lip apex constricted, but this feature was not observed in any of the specimens examined and is probably an artifact. Vegetatively, *M. valerioi* Ames & C. Schweinf. is identical with the complex but has crystalline white flowers with a distinctly spatulate lip.

Maxillaria dichotoma (Schltr.) L. O. Williams, Bot. Mus. Leafl. 9:15. 1940. Camaridium dichotomum Schltr., Repert. Spec. Nov. Regni Veg. Beih. 8:98. 1921. TYPE: Pincincha, in regione subtropica vallis Nanegal, Sodiro 94 (not found). Maxillaria paleata of authors. Not (Rchb. f.) Ames & Correll. Figure 14B.

Plant a straggly, pendent or decumbent epiphyte to about 1 m tall comprised of several successive shoots anchored only at the base; each shoot to 18 cm long, terminated by a pseudobulb. Roots white, to less than 1 mm in diameter. Pseudobulbs ovoid, compressed, 1.5–4 cm long, 1–2.5 cm wide, subtended when young by 1–3 foliaceous sheaths; apex 1-foliate. Leaves both apical and along the rhizome; foliate bracts broad, narrowing abruptly above the articulation to form a slender petiole; apical leaf petiolate; all blades elliptic, 2.5–20 cm long, 1.5–5 cm wide, acute or acuminate. Inflores-

cence short, lateral, single flowered, produced precociously on the canes of developing shoots; scapes to about 1.5 cm long, concealed by rhizome bracts; ovary with pedicel 7–9 mm long, subtended by a cucullate, acute or subulate floral bract 1.3–2.1 cm long. Flowers variable in color, mostly yellow or less often white tinged with purple or pink. Sepals similar; dorsal elliptic, 1.4–1.7 cm long, about 5.5 mm wide, acute; lateral sepals obliquely ovate-lanceolate, 1.4–1.8 cm long, about 6 mm wide. Petals elliptic, 1.3–1.6 cm long, 3.5–5.5 mm wide. Lip hinged to the column foot, 3-lobate below the middle, strongly arched, 8–10 mm long, about 5 mm wide with side lobes spread; midlobe fleshy, ovate; callus fleshy at the base terminating at the sinuses. Column stout, 4–5 mm long excluding anther; foot about 3 mm long; anther about 2 mm in diameter.

Epiphytic on the larger branches and trunks of trees in premontane and lower montane evergreen forests at 500–1700 m. Flowering at least August to April and probably throughout the year. Costa Rica and Panama to Colombia, Ecuador, and Peru; doubtfully in Nicaragua as reported.

This little-known species has the broadest range among its relatives, *M. minor* (Schltr.) L. O. Williams, *M. paleata* (Rchb. f.) Ames & Correll, *M. schlechteriana* J. T. Atwood, *M. sigmoidea* (C. Schweinf.) Ames & Correll, and *M. vaginalis* Rchb. f.

Maxillaria diuturna Ames & C. Schweinf., Sched. Orch. 8:58. 1925. TYPE: Panama, *C. W. Powell 376* (holotype: AMES). Figure 16B.

Plant a straggly, usually pendent epiphyte with successively borne shoots developing 3-10 cm apart, with only the lowermost shoots forming roots. Roots white, rather large, to 1.5 mm in diameter. Pseudobulbs compressed and sharp edged, 2-3.5 cm long and 1.5-2.5 cm wide, apically truncate to emarginate 1-foliate, sheathed at the base with 2–4 leaf-bearing sheaths. Leaves shortly petiolate, elliptic-oblong, acute to obtuse, rarely rounded, the apical leaf 5.5-12 cm long and 1.5-3.5 cm wide. Inflorescences appearing singly within each rhizome bract of the immature shoot, to about 4 cm long, covered by few bracts below the ovary but mostly hidden from view by the rhizome bracts; ovary with pedicel much longer than the subtending floral bract, 2-2.5 cm long. Flowers clear yellow to greenish yellow, the lip sometimes red at the base and the column with a few red spots on the lower side. Sepals similar, 1.4-1.5 cm long, 6-7 mm wide, acute; dorsal ovate-lanceolate; lateral sepals obliquely ovate, forming a mentum at the column base. Petals ovate, 1.1-1.2 cm long and 5-7 mm wide, acute to obtuse. Lip hinged to the column foot, ovatepandurate, vaguely 3-lobulate, apically rounded and constricted at about the apical ½, 10-12 mm long, 5-6 mm wide; callus narrowly ovate and obtuse, fleshy, lightly 3-ridged on the lower ½. Column arcuate, to 8 mm long including the 3-mm foot. Capsule ellipsoid to 2.5 cm long.

Fairly common epiphytic or rarely terrestrial herb in rain forests at 50–1000(1600?) m. Flowering throughout the year. Nicaragua to Panama and probably Colombia.

The ascending shoots rooted only at the base of the plant and sharp-edged, apically truncate to emarginate, 1-foliate pseudobulbs are unique features among Central American maxillarias. It is perhaps most closely related to *M. nagelii* L. O. Williams, a species from Mexico.

Maxillaria dressleriana Carnevali & J. T. Atwood, Lindleyana 11:29–31. 1996. TYPE: Panama, Chiriquí, flowered in cultivation at the Marie Selby Botanical Gardens, 3 Jan. 1995, *Carnevali 3858* (holotype: SEL; isotypes: AMES, INB, MO). Figure 21D.

Plant a cespitose, epiphytic herb 25–30 cm tall. Rhizome short, clothed by scarious sheaths. Pseudobulbs dull dark green, tinged with dull dark maroon basally in older pseudobulbs, clustered, 2.5-4 cm tall, 1-1.5 cm wide and thick, ovoid or ovoid-ellipsoid to somewhat conic; subtended by nonfoliate sheaths; apex 1-foliate. Leaves erect on the pseudobulb, coriaceous, elliptic or rarely ovate-elliptic, 24-27 cm long, 2-3 cm wide, petiolate, acute. Inflorescence erect, shorter than pseudobulb; scape 8-12 mm long, terete; ovary with pedicel 1.4-1.9 cm long, subtended by a floral bract 1.7-2.1 cm long, 1.1–1.5 mm wide. Flowers deep dull red-maroon, petals paler with a yellowish cast, lip dark red-maroon, apex dull deep yellow, column dull pale cream-yellow. Sepals somewhat fleshy; dorsal slightly concave and subparallel to the column, oblong-elliptic, 1.5-1.6 cm long, 6.5-7 mm wide; apex obtuse-rounded; margins somewhat revolute; lateral sepals widely spreading, somewhat oblique, 1.5-1.7 cm long, 5-6 mm wide; apex obtuse or obtuse-rounded; margins revolute. Petals subparallel to column, narrowly obovate or narrowly obovate-oblong, 1.4-1.5 cm long, 4.55 mm wide; apex acute or obtuse-rounded; margins somewhat revolute. **Lip** 3-lobate, 1.4–1.6 cm long, 7.5–8.5 mm wide when expanded; lateral lobes falcate-uncinate, acute, emerging just below the middle portion of the lip, 1-1.5 mm long, ca. I mm wide at base; midlobe subquadrate-oblong or subquadrate-pandurate, somewhat broadened apically, 7.5-9 mm long, 4.5-5.5 mm wide; apex subtruncate, shallowly emarginate; disc with a farinose yellow callus reaching midlength of the midlobe. Column arcuate, broadly winged apically, 8–10 mm long, 4–5 mm wide; column foot 4-5 mm long; anther smooth.

Poorly known ecologically; 80 m. Flowering November. Endemic to Costa Rica and western Panama.

Within the *M. rufescens* Lindl. complex in Costa Rica, the dull, dark maroon flowers are unique.

Maxillaria elatior (Rchb. f.) Rchb. f., Ann. Bot. Syst. 6:532. 1863. *Dicrypta elatior* Rchb. f.,

Linnaea 18:403. 1844. TYPE: Guatemala, Quezaltenango, Leibold 14 (not seen). ?Camaridium xylobiichilum Kraenzl., Vidensk. Medd. Nat. Copenhagen 71:174. 1920. TYPE: Locality unknown (drawing of type: AMES). Maxillaria triangularis Lindl., Edwards's Bot. Reg. 31: Misc., p. 9. 1845. TYPE: Guatemala Hartweg s.n. (holotype: K). Maxillaria albertii Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 229. 1923. TYPE: Costa Rica, Alajuela, Rio Jesus de San Ramon, Brenes 257 (lectotype: CR; isolectotype: AMES). Figure 7F.

Plant large to 1 m tall, forming conspicuous canes, straggly, pendent when large; shoots comprising each cane forming 2-10 cm apart. Roots white, large, to 2 mm in diameter. Pseudobulbs subtended by 1-several leaf-bearing rhizome bracts, apically 1–2-foliate, ovate, smooth, compressed, 4–8 cm long, 2–3 cm wide. Leaves petiolate, the blade coriaceous, 5-30 cm long, 2-4 cm wide. Inflorescence 1 per rhizome bract axil of immature shoots, to about 5 cm long, excluding the pedicel and ovary, covered by 3 or more acute, imbricating sheaths; ovary with pedicel 3.2-5 cm long, far exceeding the subtending floral bract. Flowers orange to red or greenish yellow flushed with red. Sepals ovate-lanceolate, 2-2.6 cm long, 7-10 mm wide, acute; lateral somewhat oblique. Petals falcate-lanceolate, about 1.8-2.2 cm long, 4-5.5 mm wide. Lip simple when spread, elliptic-ovate, slightly 3-lobulate just below the apical 1/3, about 1.7 cm long and 9-10 mm wide, the sides somewhat infolded around the column; apex tapering, somewhat obtuse, recurved; callus a broad, thickened, biblike ligule on lower ½-¾, rounded to slightly Vshaped in front. Column arcuate, about 1.2 cm excluding the anther; foot 3-4 mm long; pollinia 4, supported on a saddle-shaped viscidium and a short, squarrose stipe. Capsule ellipsoid, 4-5 cm long.

Epiphytic on larger branches of evergreen forests, apparently tolerant of various elevations (400–1500 m). Flowering September to April. Mexico to Costa Rica.

The type of *Dicrypta elatior* Rchb. f. (*Leibold 14*) was not found, but a specimen so labeled in Reichenbach's handwriting (*Leibold 44*) indicates that the collection number may have been misprinted.

Costa Rican *M. elatior* was originally described as *M. albertii* by Schlechter, who compared it with *M. houtteana* Lindl., not *M. elatior*. Over the whole range, pseudobulbs may have one or two apical leaves, and specimens from Belize show the short rhizomes between pseudobulbs as seen in Costa Rica. The only remaining difference between Costa Rican plants and those to the north seems to be the tendency for narrower leaves in Costa Rica.

Maxillaria endresii Rchb. f., Gard. Chron. n.s. 26:680. 1886. TYPE: Costa Rica, Edward Low s.n. (holotype: w). Figure 20B.

Plant a densely cespitose epiphyte forming large clumps. Roots white, large to 2 mm in diameter. Pseudobulbs sessile, 3.5-6 cm long and 2.5-4 cm wide, shiny but strongly ridged in the dried specimen, compressed, ovoid to orbicular, and apically obtuse, truncate or emarginate, 1-foliate, subtended and covered when young by a pair of acute sheaths to 7 cm long. Leaves large, the long petiole to ½ the blade length; blade elliptic-oblong, 15-35 cm long and 4-7 cm wide, acute to obtuse. Inflorescence to about 15 cm, 1-flowered per rhizome bract forming on mature shoots, sheathed by 4-7 bracts; ovary with pedicel 2.5-3 cm long. Flowers strongly scented, variable in floral segment attenuation, the perianth yellow within, lighter on the abaxial side, the lip bright yellow with a white margin, the lateral lobes striped with purple. Sepals similar, acute; dorsal oblong, erect 5.5-7 cm long, 9 mm wide, the lateral sepals lanceolate, falcate, 5.5-8 cm long, 1 cm wide. Petals light yellow, smaller than the sepals, broadened at the base, linear-lanceolate, 4.5-6.5 cm long, 7 mm wide, attenuate. Lip abruptly 3-lobate at the middle, puberulent centrally, 2.5-3 cm long, 1.2 cm wide, the rather narrow lateral lobes overlapping the large, orbicular, recurved midlobe; callus simple, extending to just below the middle, more or less V-shaped in front. Column white, lined with purple, cylindric, somewhat arcuate, 2 cm long including the 8-mm-long foot; anther bed magenta, coarsely ciliate; anther cap brownish, 3 mm long. Capsule ellipsoid, to 3 cm long.

Epiphyte of larger trunks in evergreen primary forests at 50–700 m. Flowering March to May and September. Nicaragua to Panama; possibly into South America, where specimens may be misidentified as *M. luteoalba* Lindl.

The truncate, rounded pseudobulbs with large leaves supported on long petioles and large, fragrant flowers with attenuate floral segments are good features for field recognition.

Maxillaria endresii has been confused with the South American M. luteoalba Lindl., which has a lip with broader side lobes and a nonorbicular pseudobulb. It is also similar to M. angustisegmenta Ames, Hubbard & C. Schweinf., a higher elevation species from Costa Rica and Panama with subconic pseudobulbs, shorter perianth segments, and broader side lobes.

Maxillaria exaltata (Kraenzl.) C. Schweinf., Bot. Mus. Leafl. 11:272. 1945. Camaridium exaltatum Kraenzl., Bot. Jahrb. Syst. 37:386–387. 1906. TYPE: Peru: Department of Loreto, mountains east of Moyobamba, Weberbauer 4620 (photo of type: AMES). Figure 6C.

Plant a somewhat straggly epiphyte to about 2 m tall, forming upright or decumbent canes to about 1 cm in diameter, concealed by rugose sheaths. Roots to about 1 mm in diameter. Pseudobulbs reduced to slight swelling near the stem apex or essentially absent. Leaves subcoriaceous, linear-lanceolate, increasing in size near the stem apex, to about 20 cm long and 2.5 cm wide, acute. Inflorescences several per leaf axil, the peduncles about 5 cm long and concealed by bracts; ovary with pedicel 1.5-1.8 cm long, exceeded by the subtending somewhat inflated floral bract. Flowers white or cream, lip pink to red-violet with yellow midlobe; segments not broadly expanded. Sepals dissimilar, the dorsal oblong, 1.8-2 cm long, 5-6 mm wide, acute; lateral sepals obliquely inserted on the column foot, oblong to triangular, 2.2-2.4 cm long, about 5 mm wide, acute. Petals oblong, somewhat falcate, oblique at the base, 1.6-1.8 cm long, 3-3.5 mm wide, acute. Lip somewhat obovate when spread, 1.2-1.4 cm long, 5.5-6.6 mm wide, 3-lobate on the apical ¼; side lobes somewhat clasping the column; midlobe fleshy, verrucose, bluntly acute to obtuse, about 2.5 mm long and wide. Column 6-7 mm long excluding the anther; foot 7-7.5 mm long; anther verrucose, 2.5 mm long.

Epiphytic in cloud forests at 650–1500 m. Flowering in Central America September to March and July. Peru (type) to Costa Rica.

Maxillaria exaltata is a member of the M. meridensis Lindl. complex, characterized by the upright canes, which are somewhat swollen terminally and concealed by rugose sheaths. This species differs from M. meridensis by the much larger plant size and by the lip, which has a nearly orbicular midlobe. It is also a species of lower elevations, and M. meridensis flowers March to August (December). Both species have been seen growing within a few meters of one another at Tapantí.

Maxillaria falcata Ames & Correll, Bot. Mus. Leafl. 11:15. 1943. *Ornithidium costaricense* Schltr., Repert. Spec. Nov. Regni Veg. 8:456. 1910. TYPE: Costa Rica, *Pittier (Tonduz?)* 2177 (lectotype selected here: AMES 24213). Not *Maxillaria costaricensis* Schltr. Figure 7C.

Plant an erect to decumbent epiphyte or terrestrial to about 1 m high, lacking pseudobulbs (juveniles?); canes monopodial, erect, branched, sometimes fasciculately so, concealed by leaf sheaths. Roots to about 1 mm in diameter. Leaves usually deciduous along the lower cane, with rugose sheaths; blade above the articulation thin, conduplicate, oblong-lanceolate, abaxially keeled, 3.5–16 cm long, 7–23 mm wide, the apex unequally 2-lobate. Inflorescences 2 or more per leaf axil, shorter than the subtending leaf; scape about 3 cm long; ovary with pedicel 1–1.2 cm long, subtended by a somewhat cucullate floral bract to about 1.7 cm long and with hyaline margins. Flowers white or pinkish. Sepals similar, oblong, 1.8–2.4 cm long, 4–5.5 mm wide, acute. Petals elliptic-

oblanceolate to somewhat falcate and attenuate, 1.7–2.4 cm long, 5–6 mm wide. **Lip** rigidly attached to the column, 3-lobate on the apical ¼–⅓, 5.5–6.5 mm long, about 4 mm across the lateral lobes when spread; lateral lobes falcate, rounded, longer than the subacute, subovate midlobe; callus from the base to above the middle, low and lamellate at the base, high and 3-keeled in front. **Column** longer than the lip, cylindric, slightly arcuate, 7.5–8 mm long excluding the anther; foot about 1 mm long.

Epiphytic or terrestrial on steep embankments at 1800–2400 m. Flowering February and March. Costa Rica and Panama.

This species is easily distinguished from similar ones by the relatively large lateral lobes of the lip, which are exceeded by the column. Lips are often lacking, probably having been eaten by insects.

The drawing at AMES of Ornithidium costaricense is labeled as based on Tonduz 2177, not Pittier 2177. A notebook at US includes the collections of both Tonduz and Pittieri (and Biolley) within the same institutional numbering system; therefore, the confusion is understandable. The original Latin description agrees well with the drawing, which is all that has been found of the original materials.

Maxillaria flava Ames, Hubbard & C. Schweinf., Bot. Mus. Leafl. 3:41. 1934. *Ornithidium ra-monense* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:243–244. 1923. TYPE: Costa Rica, San Pedro de San Ramón, *Brenes 137* (photograph of type: AMES). Not *Maxillaria ramonensis* Schltr. Figure 12D.

Plant an erect or pendent, cane-forming epiphyte to about 30 cm tall, rooted only on the lower shoots; stems much elongate, to about 7 cm long between pseudobulbs in the lower shoots, diminishing in successive shoots. Roots to about 1 mm in diameter. Pseudobulbs conic and rather truncate, clearly and regularly furrowed in dried specimens, 1–3 cm long, subtended by 1–2 foliate sheaths, the apex 1-foliate. Leaves similar, those subtending the pseudobulb with sheath; apical leaf without petiole; blades thin, elliptic, 1-7 cm long, 4-14 mm wide, rounded to emarginate, abaxially keeled. Inflorescence 1 per rhizome bract of both mature and immature shoots; 8-20 mm long; ovary with pedicel 5-8 mm long, somewhat exceeded by the subtending acute, floral bract. Flowers not opening widely or with sepals and petals recurved, greenish yellow. Sepals subequal, elliptic-lanceolate, 9-12 mm long, 1.5-2.5 mm wide; laterals subfalcate. Petals elliptic-lanceolate, 7.5-10 mm long, 2-2.5 mm wide, acute. Lip hinged with the column foot, convex, ovate when spread, 3-4.5 mm long, about 2 mm wide, 3-lobate on the lower quarter, recurved in natural position; lateral lobes shorter than the callus, short and acute; midlobe ovate, rounded to emarginate; callus fleshy, rounded and somewhat elevated in front, terminating below the middle. Column stout, arcuate, somewhat tapering, 2.5–3 mm long excluding the anther; foot about 1 mm long; anther less than 1 mm in diameter.

Epiphytic in cloud forests at 700-1350 m. Flowering October and November. Endemic to Costa Rica and Panama.

Maxillaria flava is similar to M. microphyton but unique in the distinctly furrowed pseudobulbs. The flowers are apparently always yellow, lacking the red stripes or suffusion seen in related species; hence the name. The short lateral lobes of the lip exceeded by the callus readily distinguishes this from M. microphyton Schltr.

Maxillaria friedrichsthalii Rchb. f., Bot. Zeitung (Berlin) 10:858. 1852. TYPE: Guatemala, Chontales, in Monte Aragua, Friedrichsthal (isotype: AMES). Maxillaria turialbae Schltr., Beih. Bot. Centralbl. 36:414–415. 1918. TYPE: Costa Rica, Turialba, F. C. Lehmann 1098 (drawing of type: AMES). Figure 8C.

Plant a loosely straggly epiphyte, or if cespitose then formed of a cluster of successively borne shoots. Roots fibrous, white, to 1 mm in diameter. Pseudobulbs oblong, 1-3 cm apart, 3-5 cm tall and 6-15 mm wide, somewhat laterally flattened and with several vertical ribs more conspicuous when dried, subtended by 1-2 early deciduous blade-bearing bracts, apically 2-3-foliate. Leaves linear to oblong, 3.5-15 cm long and 3.5-12 mm wide, unequally 2-lobed apically. Inflorescence lateral, borne singly per rhizome bract axil, the peduncles 1.5-3 cm long covered by 5-7 bracts; ovary with pedicel 10-15 mm long, entirely concealed by a subtending pair of bracts, the uppermost 11-17 mm long. Flowers with a slight urinous odor, coriaceous, not opening fully and difficult to spread, white to yellowish, turning greenish with age, the lip often yellow centrally and flushed or rarely spotted lavender laterally. Sepals similar, oblong-lanceolate, concave, 15-20 mm long, 3.5-5 mm wide, acute; lateral sepals falcate, adnate to the column foot. Petals falcate, elliptic-oblong, 13-18 mm long, 2-3 mm wide, acute. Lip hinged with the column foot, elliptic oblong, very slightly 3-lobate, 12-15 mm long; callus linear, basal, extending to about the middle. Column 9-11 mm long, including the short foot; pollinia with long stipe, anther bed ciliate.

Epiphytic in wet forests at 50–1500 m. Flowering mostly November to March. Mexico (Campeche), Belize, and Guatemala to Panama.

This species is usually confused with *M. acian-tha* Rchb. f. and *M. scorpioidea* Kraenzl. It has the smallest flowers of the three species, is the most frequently seen, and has a broader range and perhaps ecological tolerance in Central America than the other two. Schlechter moved his own species, *M. turialbae*, into synonymy with *M.*

friedrichsthalii, and the floral dimensions given in his original description fit this concept exactly, not with M. aciantha or M. scorpioidea.

Maxillaria fulgens (Rchb. f.) L. O. Williams, Ann. Mo. Bot. Gard. 28:425. 1941. *Ornithidium fulgens* Rchb. f., Beitr. Orch. Centr.-Am. 76. 1866. TYPE: Costa Rica, "Naranjo," *Wendland* (holotype: w; photo of type: AMES). Figure 6A.

Plant a robust, shrublike, or cane-forming epiphyte to about 70 cm tall, with 1-several branches anchored only at the base, each branch consisting of 1 or more shoots produced successively 10-20 cm apart and terminating in a 1-foliate pseudobulb. Roots large, to 3 mm in diameter. Pseudobulbs to about 3 cm long, conic, subtended and hidden by 2-5 blade-bearing bracts. Leaf blades coriaceous, lanceolate, to narrowly elliptic, somewhat petiolate above the articulation, 9-20 cm long, 1.5-4.5 cm wide, acute. Inflorescence a fascicle of 2-8 single-flowered scapes produced in the bract axils of the developing vegetative bud, each scape 2-3 cm long; ovary with pedicel 11-15 mm long. Flowers globose, the segments not spreading widely, bright red, lip yellow. Sepals broadly triangular-ovate, 7 mm long, 4-4.5 mm wide, acute to obtuse. Petals elliptic-ovate, slightly clawed at the base, 6 mm long, 2.5-3 mm wide, acute. Lip rigidly attached to the column, 5 mm long in natural position, difficult to spread, constricted in the middle, saccate on the basal half, the apex deflexed. Column stout, 2.5 mm long; foot about 2 mm long.

Epiphyte of the larger branches in wet forests at 100–2000 m. Flowering June to December, February, April, and May. Nicaragua to Panama, and northern South America.

This species is one of the most remarkable for its paedomorphic habit of producing several flowers per bract axil of a vegetative shoot barely beyond the bud stage. The multiple flowers appear superficially to arise from rhizome bract axils of the already developed shoot.

Maxillaria gomeziana J. T. Atwood, Lindleyana 11:202–204. 1996. TYPE: Costa Rica, Province of Puntarenas, Coto Brus, 1600 m. Mar. 1995, *Atwood, C. & J. Luer ex Atwood 5052* (holotype: SEL). Figure 16D.

Plant a somewhat ascending, canc-forming epiphyte to about 30 cm tall, comprised of shoots 5–10 cm long including the pseudobulb. Roots ≤ 1 mm in diameter. Pseudobulbs fusiform, compressed, 1-foliate, 3.5–5 cm long, 1–1.5 cm wide, subtended by 1–4 strongly rugose sheaths, the uppermost with soon deciduous blades. Leaf blades shortly petiolate, subcoriaceous, lincar-oblong, 12–28 cm long, 1–1.5 cm wide, the apex unequally 2-lobate. Inflorescences 1–3 per foliaceous sheath axil;

scapes 2.5-4 cm long; ovary with pedicel 11-15 mm long, trigonous, subequal to the subtending floral bract. Flowers with somewhat spreading segments, pale yellowish green, lip marked with red apically and on side lobes. Sepals similar, oblong to oblanceolate, 1.7-2.3 cm long, 4-5 mm wide, acute; dorsal somewhat keeled dorsally and apically; lateral sepals recurved. Petals elliptic-oblanceolate, 1.6-1.8 cm long, 3-4 mm wide, acute. Lip hinged to column foot, 3-lobate below the middle, 1-1.2 cm long, 6-8 mm wide when spread; lateral lobes rounded, somewhat erect; midlobe fleshy, oblong-obovate with recurved lateral margins in natural position, rhombic when spread, rounded, abaxially keeled; callus fleshy, thickened and rounded in front, ending below sinuses between lobes, with a blunt central and 2 less distinct lateral keels. Column stout, somewhat arcuate, 5-6 mm with anther, 3.5-4 mm without anther, foot about 2 mm long. Capsule 3-winged.

Poorly known epiphyte at (200)400–1620 m. Flowering at least August, October, and February; flowering in cultivation at SEL October to December. Native to Panama and adjacent Costa Rica.

Only recently has a living plant of *M. gomeziana* been observed in flower, hence the delay in its description. It is closely related to *M. bracteata* (Schltr.) Ames & C. Schweinf., with which it shares the central keel of the callus, but has narrower leaves, more slender pseudobulbs, more slender perianth segments, and trigonous ovaries that develop into trialate capsules. (See Addendum, p. 173.)

Maxillaria haberi J. T. Atwood, Selbyana 16: 245. 1995. TYPE: Costa Rica, Province of Heredia, forest between Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva, 700–750 m, 4 Apr. 1986, *M. H. Grayum 6769* (holotype: CR). Figure 11E.

Plant a conspicuously rhizomatous epiphyte to at least 50 cm tall, probably pendent when large; rhizome 6-8 mm in diameter, 7-10 cm long between pseudobulbs, concealed when young by acute, nonfoliaceous bracts. Roots slender, to 1 mm in diameter. Pseudobulbs ovate, compressed, subtended by 1-3 leaves, 3.5-5 cm long, 1.5-2 cm wide, with 1-foliate apex. Leaves elliptic-oblanceolate, conspicuously petiolate, the blade 12-22 cm long, 4-6 cm wide, acute. Inflorescence appearing in the flush of new growth, scapes 4-5 cm long, ovary 10-13 mm long, somewhat exceeded by the subtending floral bract. Flower somewhat spreading, yellow to orange or tan, the lip maroon-red near base, white near apex. Sepals similar, elliptic-lanceolate, 3.8-4.1 cm long, 1 cm wide, acute. Petals oblanceolate, about 3.7 cm long, 6 mm wide, acute. Lip rather fleshy, obovate in general outline, 2.5 cm long, 1.8 cm wide when spread, 3-lobate on the upper 1/3; lateral lobes embracing the column; midlobe subquadrate, obtuse; callus of 3 keels from the base to below the sinuses of the lateral lobes, the middle keel lower and less distinct than the

outer. Column slightly arcuate, 1.8–2 cm long excluding unknown anther, with a swelling on the lower ½ ventral side.

Epiphytic at 850 m. Flowering at least April, July, and September. Endemic to Costa Rica; known only from the Peñas Blancas Valley near Monteverde.

Maxillaria haberi is known only from three collections made between 1986 and 1989: Grayum 6769 (CR), Bello & Cruz 1023 (INB), and Haber & Cruz 7474 (MO). Apparently a rare species; recent attempts to relocate it have failed.

It is most readily distinguished by the combination of long rhizomatous habit with 1-foliate pseudobulbs terminating each shoot, the large elliptic-oblanceolate leaves, and the relatively large yellow flowers. The plant appears similar to that of *M. planicola* C. Schweinf. but has foliaceous sheaths at the base of the pseudobulbs. The flowers are also large as in *M. planicola*, but the lip is proportionately longer and has a callus of three keels rather than of stiff hairs and a ligule.

Maxillaria hedwigiae Hamer & Dodson, Ic. Pl. Trop. 8: t. 800. 1982. TYPE: Guatemala, Río Dulce, near Lake Isabal, *Hamer A 161* (holotype: SEL). Figure 21C.

Plant a cespitose epiphyte, sometimes forming large clumps. Roots large, to 2 mm in diameter. Pseudobulbs rugose, ovoid-conic, 1-foliate, to about 4.5 cm long and 2.5 cm wide, sheathed basally when young by 4-6 acute, nonfoliate bracts. Leaf thin, petiolate, the blade narrowly elliptic, to 36 cm long and 3.5 cm wide (usually smaller), acute. Inflorescence 3–5 cm long with 3 or 4 acute bracts about 1.5 cm long; ovary with pedicel 2.2–3 cm long, exceeding the subtending floral bract. Flowers white to cream or greenish, or probably turning greenish with age; lip bright orange. Sepals elliptic, 17– 19 mm long, 7-9 mm wide. Petals elliptic, 15-17 mm long, 6-7 mm wide. Lip 3-lobate at about the middle; lateral lobes erect, lanceolate; midlobe very fleshy, somewhat lanceolate but with a truncate to retuse apex; callus spatulate, extending to about the middle. Column arcuate, clavate, about 9 mm long, with a short foot about 1 mm long and winged on the ventral side of the upper half. Capsule ellipsoid, 2 cm long.

Epiphytic at 0–650 m. Flowering (October) November to March. Locally common from (Mexico?) Guatemala to Costa Rica.

The white to greenish white or cream flowers with distinct orange lip are the best features for recognition. Also, the midlobe is usually lanceolate and more or less acute, unlike its relatives, *M. acutifolia* Lindl. and *M. moralesii* Carnevali & J. T. Atwood, which have truncate apices.

Maxillaria horichii Senghas, Orchidee (Hamburg) 28:13. 1977. Figure 3. TYPE: Costa Rica, "near Sisicá, between La Palma de San Isidro del General and Playa Dominica," *Horich s.n.* (holotype: HEID, not seen). *Sepalosaccus horichii* (Senghas) Senghas, Orchideen 29:1745. 1994. Figure 10A.

Plant a straggly, rhizomatous epiphyte rooted only on the lower shoots; rhizome elongate, to 5(6) mm in diameter, concealed by bracts, pendent, forming shoot systems to about 50 cm long. Roots fibrous, rarely more than 1 mm in diameter. Pseudobulbs cylindric to ovoid, compressed, subtended by 2-3 subulate, nonfoliaceous bracts, 2-3 cm long, 1.2-2 cm wide, apically 1-foliate, spaced 3-9 cm apart on the rhizome. Leaves shortly petiolate; blade lanceolate, 8-19 cm long, 1.2-2.8 cm wide, acute. Inflorescences in fascicles borne at the base of the recently matured pseudobulb; scapes to about 1.5 cm long, mostly concealed by the rhizome bracts; ovary and pedicel about 5 mm long, concealed by inflated, ovate scape bracts. Flowers bright orange, column sometimes (always?) white. Sepals dissimilar, not opening widely; dorsal elliptic-ovate, concave, 7–9 mm long, 3-4 mm wide; lateral sepals ovate, about 34 connate, 7.5-10 mm long, 4-5 mm wide, acute. Petals ligulate, 6-7 mm long, about 2 mm wide, acute. Lip rigidly attached to the column foot, reflexed at about the middle when viewed laterally, 5-6 mm long when straightened, the basal half canaliculate, the apical half 3-lobate; lateral lobes reduced to auricles; midlobe very bluntly Vshaped, provided with a similarly bluntly V-shaped callus at the midlobe base. Column stout, about 2 mm long excluding the anther; anther with a beak; pollinia 4, supported on a distinct stipe about 1 mm long and a saddleshaped viscidium; rostellum prominent.

Epiphytic in premontane rain forests at 500–1500 m. Flowering material has been collected September to November and July. Costa Rica from the region of San Isidro del General, Province of San José to Boquete, Panama.

Maxillaria horichii is unique in the more or less urseolate red flowers resembling those of species of Mediocalcar from New Guinea. Although similar to M. pseudoneglecta (see below), the lip (especially when spread) and column are quite different. The lip of M. horichii is narrowly cuneate at the base with a relatively long, broadly lanceolate midlobe, and the lateral lobes are reduced to auricles. When viewed laterally, the lip appears boomerang shaped. The callus is bluntly V-shaped in front and not transversely straight and continuous with the lateral lobes as in M. pseudoneglecta. Although the orange-colored forms seen in M. pseudoneglecta suggest hybridization with M. horichii, available herbarium specimens reveal no flowers with intermediate morphology.

Maxillaria inaudita Rchb. f., Beitr. Orch. Centr.-Am. 76. 1866. TYPE: Costa Rica, Cartago, Wendland s.n. (holotype: w). Figure 2C.

Plant epiphytic, cespitose, as juveniles consisting of tightly clustered shoots with pseudobulbs; at maturity producing a cluster of elongate, monopodial, decumbent, leafy canes to 1 m tall. Roots large, to 2 mm in diameter. Pseudobulbs of juveniles ovoid, apically 1-foliate, to 5 cm long. Leaves coriaceous, distichous on the canes, 3-7 cm apart, shortly petiolate above the articulation, the sheaths rugose, the petiole narrowing just above the articulation, the blade 5-20 cm long, 2-5 cm wide, oblong-elliptic, often striate, the apex variable, usually rounded to obtuse, sometimes emarginate. Inflorescences lateral on the canes, single per leaf axil, short, rarely reaching the subtending blade apex; scapes 5-8 cm long, mostly concealed by acute sheaths and the subtending leaf sheath; ovary with pedicel 14–18 mm long, usually exceeded by the subtending inflated floral bract. Flowers white to light yellow, the lip darker yellow or spotted with dark yellow near the apical margin. Sepals elliptic to lanceolate, 3-6.5 cm long, 7-12 mm wide, acute. Petals narrowly elliptic, falcate, 2.5-6 cm long, 5-10 mm wide. Lip cuneate, apically 3-lobate, 1.5-2 cm long, 1.2-1.7 cm wide when spread; callus 3-carinate to just above the middle. Column arcuate, 1.2-1.5 cm long including the short foot; pollinia 4, supported on short, squarrose stipe with viscidium. Capsule narrowly obovoid, 5-6 cm long.

Epiphytic in cloud forests at 800–1800 m. Flowering throughout the year in Costa Rica; January to June in Panama. Costa Rica and Panama.

Sometimes confused with the much smallerflowered M. trilobata Ames & C. Schweinf., M. inaudita is easy to recognize by the large light vellow to white flowers. Maxillaria inaudita var. minor Ames & C. Schweinf. is described as having flowers about half the size of those of typical M. inaudita, and most of the available samples from Panama show this smaller tendency. Most herbarium specimens include only upper stem portions lacking pseudobulbs, which probably explains why Reichenbach's description indicates that the species lack pseudobulbs. Approximate shoots with apically 1-foliate, ovoid pseudobulbs do develop in juveniles, and the mature canes develop from these. Juveniles appear very different from the adults.

Maxillaria lankesteri Ames, Sched. Orch. 7:11–12. 1924. TYPE: Costa Rica, Lankester 508 (holotype: AMES). Ornithidium aurantiacum Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 241. 1923. Costa Rica, San Pedro de San Ramón, Brenes 129 (drawing of type: AMES). Not

Maxillaria aurantiaca A. Rich. & Gal. Figure 13B.

Plant a somewhat straggly epiphyte to 20 cm tall; rhizome erect or decumbent, rooted mostly at the base; rhizome segments to about 8 cm long between pseudobulbs. Roots to 0.5 mm in diameter. Pseudobulbs cylindric to somewhat tapered, 1-3 cm long, about 7 mm wide at the base; subtended by 1-2-foliate sheaths; apex 1-foliate. Leaves coriaceous to fleshy, sessile, elliptic, 1-3.5 cm long, 7-13 mm wide, with unequally 2-lobate apex. Inflorescence 1 per rhizome bract axil of the developing shoot; scape to about 1.5 cm long; ovary with pedicel 7 mm long, nearly concealed by the subtending floral bract. Flowers translucent tan with maroon stripes. Sepals similar, elliptic to oblong-lanceolate, 1.2–1.4 cm long, 3-3.5 mm wide, acute; laterals inserted on the column foot. Petals elliptic-lanceolate, about 11 mm long, 3 mm wide, acute. Lip hinged to the column foot, elliptic-ovate in general outline, 9-9.5 mm long, 3.5 mm wide in natural position, 5.5 mm wide when spread, 3lobate at the base; lateral lobes short, not exceeding 1/5 the lip; midlobe elliptic, obtuse, the side margins much recurved; callus tonguelike, exceeding and connecting the lateral lobes. Column stout, 2-3 mm long excluding the anther; foot about 2 mm long; anther about 1.5 mm in diameter.

Maxillaria lankesteri is a poorly collected epiphyte in premontane rain forests at 600–1500 (1900?) m. Flowering July to February. Costa Rica and western Panama.

It appears to be uncommon, because few duplicate specimens are available. It has been considered as a synonym of *M. wercklei* (Schltr.) L. O. Williams, a species with somewhat smaller shoots and flowers nearly identical in morphology but much smaller in size.

Maxillaria linearifolia Ames & C. Schweinf., Sched. Orch. 10:95–96. 1930. TYPE: Costa Rica, San Ramon, A. M. Brenes (19) 314 (holotype: AMES). Figure 3A.

Plant a straggly, somewhat vinelike, essentially monopodial, pendent or decumbent epiphyte forming wiry, sparsely branched canes to about 4 mm in diameter. Roots white to grayish, to 0.5 mm in diameter. Pseudobulbs lacking, stems covered by leaf sheaths. Leaf blades narrowly lanceolate, coriaceous, shiny, 2-10 cm long, 3-8 mm wide, acute. Inflorescence single per leaf axil; scape about 1.5-2 cm long; ovary with pedicel 3-3.5 cm long, far exceeding the subtending floral bract. Flowers white or cream marked with purple spots, the lip purple or spotted with purple. Sepals narrowly ovate, 13-14 mm long, 4 mm wide, acute; dorsal somewhat concave. Petals lanceolate, falcate, 12 mm long, 3 mm wide. Lip hinged to the column foot, cuneate, 11-12 mm long, 3-4 mm wide, shallowly 3-lobate on the upper ⅓; midlobe somewhat broadened above, broadly rounded at the apex. Column arcuate, much broadened above, 8 mm long, extended into a foot 3 mm long at the base. **Capsule** ellipsoid, 2.5–3 cm long.

An epiphyte of larger branches, grasslike, sometimes forming large, hanging masses at 1200–1700 m. Flowering September to February and July. Costa Rica and Panama.

In Costa Rica, *M. linearifolia* is most similar to *M. appendiculoides* C. Schweinf. but differs in the distinctly lanceolate, not elliptic, leaves. It is similar to the South American *M. graminifolia* (Kunth) Rchb. f. and may prove to be conspecific.

Maxillaria longiloba (Ames & C. Schweinf.) J. T. Atwood, Ic. Pl. Trop. 16: t. 1562. 1993. Basionym: *Maxillaria brenesii* Schltr. var. *longiloba* Ames & C. Schweinf., Sched. Orch. 10:90–91. 1930. TYPE: Costa Rica, Province of Heredia, Yerba Buena, northeast of San Isidro. *Standley & Valerio* 49104 (holotype: AMES; isotype: US). Figure 19D.

Plant a cespitose epiphyte, sometimes forming large clumps. Roots about 1 mm in diameter. Pseudobulbs not much flattened laterally, conic-ovoid, 2.5-4 cm long, 1.5-2 cm wide, hidden by short, subulate nonfoliaceous sheaths fraying with age, apically 1-foliate. Leaf petiolate, the blade coriaceous, keeled beneath, narrowly elliptic, 17-27 cm long, 2.5-4.5 cm wide, acute. Inflorescences 2 or more per bract axil at the base of the pseudobulb, produced successively; scape 8-25 cm long, mostly concealed by 4-7 acute sheaths; ovary and pedicel 2.5-4 cm long, subtended by a usually somewhat shorter, acute, laterally flattened floral bract. Flowers fragrant, not spreading widely, greenish yellow, the lip usually black-purple. Sepals similar, somewhat concave, oblong-lanceolate, acute; dorsal 2.2-2.5 cm long, about 7 mm wide; lateral sepals adnate to the column foot, 2.4-2.7 cm long, about 8 mm wide. Petals linear-lanceolate, 2–2.2 cm long, 4 mm wide, acute. Lip articulate to the column foot, parallel with the column, about 1.5 cm long, 1.5 cm wide when spread, 3-lobate; side lobes more or less truncate apically with involute margins forming a canaliculate lip base; midlobe strongly reflexed to about 90°, exceedingly fleshy and terete, warty, the margins somewhat revolute; callus a fleshy plate, apparently pubescent (difficult to see in some herbarium specimens). Column stout, arcuate, 7-10 mm long including the anther; column foot 2-3 mm long; pollinia 4, supported on a saddle-shaped viscidium. Capsule about 6 cm long.

Epiphytic in cloud forests at 1100–2000 m; probably restricted to the dryer areas of rain shadows. Flowering October to March. Costa Rica and Panama.

Maxillaria longiloba is readily distinguished from M. brunnea Lind. & Rchb. f. by flower color and the sharply reflexed midlobe of the lip. No

hybrids have been seen in Monteverde, where both species may be seen growing together.

Maxillaria longipetiolata Ames & C. Schweinf., Sched. Orch. 8:61–62. 1925. TYPE: Panama, hill east of Corozal, *Powell 307* (holotype: AMES). Figure 19A.

Plant a cespitose epiphyte 15-35 cm tall. Roots grayish, to 1.5 mm in diameter. Pseudobulbs ovoid, to 3 cm long, 1-foliate. Leaves with distinct petiole more than 1/4 the blade; blade narrowly elliptic to linear, chartaceous to subcoriaceous, 15-27 cm long, 1-2.5 cm wide, acute. Inflorescence shorter than the pseudobulbs, in specimens seen about 1 cm long; ovary with pedicel 1.5 cm long. Flowers somewhat translucent, dull red, lip darker red and column orange with white tip (fide Ingram 832, SEL). Sepals ovate-lanceolate, 1.8-2 cm long, 5.5-7.5 mm wide, acute; lateral sepals somewhat oblique. Petals linear to narrowly elliptic, acute, 1.5–1.8 cm long, 3–5.5 mm wide. Lip hinged to the column foot, 1.4-1.6 cm long, about 8 mm wide when spread, distinctly 3-lobate at about the middle; lateral lobes rounded and forming an acute but shallow sinus with the midlobe; midlobe oblong, apically rounded to bluntly acute; callus ligulate, somewhat raised apically and terminating at the middle, apex rounded to somewhat V-shaped. Column stout, 7-8 mm long excluding the anther (1.1 cm long including the foot); foot 4-5 mm long; anther about 2 mm in diameter; stipe short and viscidium concave.

Apparently a rare canopy epiphyte in lowland rain forests at 0–550 m. Flowering at least January, June, October, and December. Costa Rica and Panama.

Maxillaria longipetiolata is easily distinguished by the long petiolate leaf and the much abbreviated scape with flowers produced at the base of the pseudobulbs. It is clearly related to South American M. auyantepuiensis Foldats.

Maxillaria lueri Dodson, Icon. Pl. Trop. 2: t. 155. 1980. TYPE: Ecuador, Pichincha, 300 m, *Dodson & Luer 6800* (holotype: SEL). Figure 2A.

Plant a pendent, somewhat straggly epiphyte to 1 m long (Ecuador); stem concealed by black-warty imbricate sheaths. Roots to 1 mm in diameter. Pseudobulbs terete, surrounded by leaf sheaths, apically 1-foliate and surrounded basally by 3–4 well-developed leaves. Leaves narrowly linear, the larger at least 30 times as long as wide, articulate to the sheath, linear, to 40 cm long, less than 5 mm wide. Inflorescences borne on short peduncles concealed by the leaf bases; ovary length about 1.5–2 cm exceeded by the floral bract. Flowers poorly known in fresh condition, pinkish white. Sepals dissimilar; dorsal elliptic, 1.8 cm long, 7 mm wide, acute; lateral sepals obliquely ovate, to 2.5 cm long, 1 cm wide, adnate to the column foot. Petals obliquely elliptic, to 1.5 cm long, 6 mm wide. Lip about

2 cm long, apically 3-lobate, the midlobe about ¼ the length of the lip, its blade with a central ligulate callus. **Column** 7–8 mm long with a conspicuous foot of about the same length.

Uncommon epiphyte of rain forests at 50–500 m. Flowering October and December. Ecuador, Panama, and Costa Rica.

Maxillaria lueri is easily recognized by the long, narrow, pendent leaves and spotted sheaths.

Maxillaria maleolens Schltr. Repert. Spec. Nov. Regni Veg. Beih. 19:233. 1933. TYPE: Costa Rica, Alajuela, *Brenes 281* (lectotype: CR). Figure 17C.

Plant a large, coarse, cespitose epiphyte. Roots, white, large, to 3.5 mm in diameter. Pseudobulbs ovate, smooth, compressed, 5–9 cm long, 2.5–3.5 cm wide, apically 1-foliate, and subtended by 2 or more large leafbearing sheaths. Leaves subcoriaceous and rather tough, 16-42 cm long, 2.2-5.5 cm wide, oblong, variously petiolate, apically obtuse to unequally 2-lobate. Inflorescence a fascicle of successively flowering scapes; each scape 4-5 cm long, covered by somewhat flared, obtuse, apiculate bracts; ovary with pedicel furfuraceous, 1.2-1.8 cm long, much exceeding the subtending, much abbreviated, collar-like floral bract. Flowers leathery, presented perpendicularly to the line of growth, with fragrance similar to that of coconut, greenish yellow, with paler lip marked with red and with yellow calli. Sepals narrowly ovate, 2.3-2.6 cm long, 1-1.1 cm wide, cuspidate. Petals elliptic-oblong to lance-ovate, broadly acute, 1.8-2.1 cm long, 5-6 mm wide. Lip hinged to the column foot, rounded at the base, 1.8-2.2 cm long, 1.4 cm wide, 3-lobate just beyond the middle; midlobe triangular; callus thickened, biblike, extended to the middle, on which is superposed an additional linear raised callus, plus an additional ovate callus on the midlobe. Column arcuate, 1.4–1.5 cm long including the minutely papillose anther cap and the obsolete foot; pollinia 4, supported on a squarrose stipe and a saddleshaped viscidium. Capsule ellipsoid, 3.5 cm long.

Apparently a rare, large, clumping epiphyte of premontane rain forests to 1150 m. Flowering throughout the year. Mexico (Veracruz) and Honduras to Panama; probably also in Guatemala.

Maxillaria maleolens is easily distinguished by the large plants with shoots producing several leaves at the pseudobulb base and yellow and red flowers with obtuse floral segments. The odor, resembling something between naphthalene and coconut, could be interpreted as "pleasant" despite the specific epithet meaning "bad odor." Similar species, M. discolor (Lodd.) Rchb. f. and M. villosa (Barb. Rodr.) Cogn., may also occur in Costa Rica. Maxillaria discolor, known from adjacent Panama, has dark leaves with a purple abaxial

surface and yellow flowers that elsewhere in the range (Surinam) have an odor similar to that of very sharp cheese. A living plant apparently of *M. villosa* presumably collected in Costa Rica has appeared at Lankester Gardens. The species lacks the purple pigment in the leaves, but the flowers are yellow and lack perceptible fragrance. These species are excluded from the flora until they can be verified with field collections.

Maxillaria meridensis Lindl., Orch. Linden 19: No. 100. 1846. TYPE: Venezuela, near Merida, 6000 ft, *Linden s.n.* (holotype: κ). Figure 6D.

Plant erect, forming canes; shoots 7–11 cm apart and terminated just above the swelling or indistinct pseudobulb, each shoot developing from the base of the swelling of the previous shoot, a feature obscured by closely imbricated, rugose-verrucose rhizome bracts. Roots to 1 mm in diameter. Leaves 4-6 per shoot, the lowermost abscising with age, the blades 5-28 cm from the articulation, and 3-9 mm wide. Inflorescence 1-2 per rhizome bract; scapes 4-5 cm long, covered by about 5 imbricate, acute sheaths to 2.3 cm long; ovary with pedicel shorter than the subtending bract, 1.5-1.8 cm long at anthesis. Flowers light yellow, sometimes tinged with pink; lip with two reddish spots. Sepals narrowly elliptic-lanceolate, 2–2.5 cm long, 5–7 mm wide; dorsal somewhat concave; lateral sepals forming a mentum around the column foot. Petals linear-lanceolate, arcuate, 1.8-2.4 cm long, 2-3 mm wide. Lip 1.2-1.4 cm long and about 7 mm wide, 3-lobate on the apical 1/3; midlobe fleshy, triangular, verrucose, about 5 mm long; callus ligulate, reaching to just above the middle, thickened apically and rounded or somewhat parabolic in front. Column arcuate, 7-8 mm long excluding the anther; anther about 2 mm in diameter. Capsule 3.5 cm long.

Terrestrial on open embankments, often on windy and cloud-swept ridges; in Costa Rica known from Cordillera de Talamanca at about 1400–1800 m. Flowering March, May, August, and September. Northern South America south to Bolivia(?) and Costa Rica.

Maxillaria meridensis is similar to M. exaltata (Kraenzl.) C. Schweinf., a species of mostly lower elevations, although they may occur sympatrically (e.g., Tapantí). That species forms a much larger plant, and the ratio of the midlobe length to the entire lip length is $\leq \frac{1}{4}$. The corresponding ratio in M. meridensis is $\geq \frac{1}{4}$.

Maxillaria microphyton Schltr., Repert. Spec. Nov. Regni Veg. 8:457. 1910. TYPE: Costa Rica, in forests of La Palma, *Tonduz 9670* (isotype: US). *Ornithidium parvulum* Schltr., Repert. Spec. Nov. Regni Veg. 9:206. 1911 (based on same collection as *M. microphyton*). *Ornithidium pallidiflavum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:143, 242–243. TYPE: Costa Rica, San Pedro de San Ramón, 1075 m, *Brenes 135* (isotype: AMES). *Maxillaria pallidiflava* (Schltr.) Senghas, Orchidaceen 29:1751. 1994. Figure 12B.

Plant an erect or pendent, cane-forming epiphyte to about 30 cm tall, rooted only on the lower shoots; stems much elongate, to about 7 cm long between pseudobulbs in the lower shoots, diminishing in successive shoots. Roots to about 1 mm in diameter. Pseudobulbs conic to suborbicular, never regularly furrowed in dried specimens, 0.7-2.5 cm long, subtended by 1-2-foliaceous sheaths, the apex 1-foliate. Leaves similar, those subtending the pseudobulb with sheath; apical leaf shortly petiolate; blades thin, elliptic, 1.5-6 cm long, 4-10 mm wide, rounded to emarginate. Inflorescence 1 per bladebearing or non-blade-bearing sheath of both mature and immature shoots; ovary with pedicel 3-4 mm long, somewhat exceeded by the subtending acute floral bract. Flowers not opening widely or with sepals and petals recurved, sometimes minutely pubescent, variously colored, greenish yellow, often suffused or lined with dark red, apparently turning dark with age. Sepals subequal, elliptic, the laterals subfalcate, 6–12 mm long, 1.5–2.5 mm wide. Petals elliptic-lanceolate, sometimes attenuate, 6-10 mm long, 2-3 mm wide, acute. Lip straight in natural position, somewhat hinged to the column foot, ovate when spread, 3.5–4.5 mm long, to about 2 mm wide, 3-lobate below the middle; lateral lobes embracing the column and exceeding the callus, bluntly acute; midlobe ovate, obtuse to rounded; callus at the base fleshy, rounded and somewhat elevated in front. Column stout, arcuate, somewhat tapering, 2-3 mm long excluding the anther; foot about 0.5 mm long; anther less than 1 mm in diameter; pollinia 4, with somewhat squarrose stipe.

Locally abundant epiphyte or terrestrial of cloud forests at 1000–2000 m. Often found growing on shrubs. Flowering mostly June to November, also March and April. Costa Rica; expected in Panama.

The straight lip with lateral lobes exceeding the callus distinguishes this from similar species, especially *M. flava* and *M. wercklei*.

Although both *M. microphyton* and *Ornithi-dium parvulum* are based on the same collection, conceivably the names are based on separate specimens that might not have been the same species. In the absence of holotypes, there is no choice but to regard the second published name as a later synonym of the first.

Maxillaria minor (Schltr.) L. O. Williams, Amer. Orch. Soc. Bull. 10:273. 1942. Camaridium minus Schltr., Beih. Bot. Centralbl. 36, Abt. 2:417. 1918. TYPE: Costa Rica, La Palma. C. Wercklé

(holotype: CR?; drawing of type: AMES). Figure 13C.

Plant a straggly, pendent epiphyte to about 1 m long comprised of several successively borne shoots to 15 cm long, each consisting of a slender, wiry, scaly rhizome (cane) to about 3 mm in diameter terminated by a pseudobulb. Roots white, to barely 0.5 mm in diameter. Pseudobulbs ovoid to orbicular, biconvex, 1-2 cm long, to 1 cm wide, subtended when young by 1-2 leaf-bearing sheaths; apex 1-foliate. Leaves 4-8 cm long, 7-12 mm wide; blades of rhizome bracts with a broad sheath, narrowing abruptly above the articulation to a slender petiole. Inflorescences 1 per rhizome bract, produced precociously on the canes of developing shoots; scapes to about 5 mm long; ovary with pedicel 3-4 mm long, subtended by a cucullate, acute, or subulate floral bract. Flowers variable in color, mostly white to salmon pink, the lip yellow. Sepals similar; dorsal oblanceolate, 7 mm long, 3 mm wide, acute; lateral sepals obliquely ovate, 5 mm long, 2 mm wide. Petals oblanceolate-obovate, 5 mm long, to 2 mm wide. Lip hinged to the column foot, 3-lobate just above the middle, 3 mm long, about 2 mm wide, the midlobe fleshy, papillose, sharply deflexed, with a fleshy callus at the base and a second U-shaped callus at the base of the midlobe. Column stout, arcuate, 1.5 mm long, with a very short foot about 0.5 mm long. Capsule globose, about 6 mm long.

Epiphytic on the larger branches and trunks of trees in wet forests at 1000–2500 m. Flowering July to March. Costa Rica and Panama.

The small flowers formed precociously on immature canes and the straggly habit are immediate field characters for recognition. *Maxillaria minor* vegetatively resembles *M. paleata* (Rchb. f.) Ames & Correll, *M. schlechteriana* J. T. Atwood, *M. sigmoidea* (C. Schweinf.) Ames & Correll, and *M. vaginalis* Rchb. f., but of these has the smallest and most dully colored flowers. The entire complex of species is found at middle to high elevations, often growing sympatrically.

Maxillaria monteverdensis J. T. Atwood & G. Barboza, Lindleyana 9:241–242. TYPE: Costa Rica, intersection of Provinces of Alajuela, Guanacaste, and Puntarenas, Monteverde Reserve, *Atwood 89-33* (holotype: SEL; isotype: CR). Figure 7A.

Plant a large, erect, monopodial, cane-forming epiphyte in adults to at least 35 cm tall (probably much taller) with leafy canes lacking pseudobulbs; juveniles cespitose and with pseudobulbs. Roots mostly restricted to the base, to about 2 mm in diameter. Pseudobulbs of juveniles about 4.5 cm tall and 2.5 cm wide, compressed, sessile, apically 1-foliate with shortly petiolate leaf. Leaves thin, articulate; blade keeled below, 4–11 cm long, 1.5–2 cm wide; apex obtuse to rounded and unequally 2-lobate. Inflorescence several per leaf axil,

long for the genus and sometimes exceeding the subtending leaf; scapes to about 8 cm long, persistent; ovary with pedicel 1.3-1.5 mm long, subtended by a somewhat longer subulate, acute floral bract. Flower large for the genus, campanulate, to about 3.2 cm long, white to pinkish with lip yellow to orange, fragrant. Sepals similar, oblong, 2.5-3.1 cm long, about 5-7 mm wide, apex acute. Petals falcate-oblanceolate, about 2.5-2.7 cm long, 6.5–9 mm wide, acute to acuminate. Lip somewhat rigid with the column foot, canaliculate on the lower ²/₃, 3-lobate on the upper $\frac{1}{3}$, about 1.5–1.8 cm long, 3.5–4 mm wide in natural position, to 2 cm long when spread; lateral lobes embracing the column; midlobe ovate, obtuse, and with crenulate margin; callus a truncate to rounded lamina terminating at about the lobe sinuses with a single papilla at the base. Column nearly straight, cylindric, 1.2-1.5 cm long excluding foot and anther; foot short, about 3 mm long.

Epiphytic in lower montane rain forests at 1500–1800 m. Flowering at least January to March. Costa Rica (Monteverde) and Panama.

Maxillaria monteverdensis is most closely related to M. amabilis but has longer ovaries and larger flowers, and the lip has a single papilla at the base instead of a distinct keel. The flowers resemble those of M. vaginalis Rchb. f., but the latter species distinctly has pseudobulbs terminating adult shoots. When described, M. monteverdensis was thought to be endemic to Monteverde, but specimens have now surfaced from Panama.

Maxillaria moralesii Carnevali & J. T. Atwood, Lindleyana 11:31–32. 1996. TYPE: Costa Rica, Alajuela, Río Angel, flowered in cultivation at Missouri Botanical Garden 25 Dec. 1994, *Car*nevali & Morales 3841 (holotype: INB; isotype: SEL). Figure 22A.

Plant a cespitose or shortly creeping epiphytic herb 8-15 cm tall. Rhizome short; roots to 2 mm in diameter. Pseudobulbs pale yellow-green, clustered, ellipsoid or oblongoid, 2-3 cm tall, 0.8-1.5 cm wide and thick, but always wider than thick; subtended by non-foliaceous sheaths; apex 1-foliate. Leaves without petiole, erect on the pseudobulb, coriaceous, elliptic or lanceolate-elliptic, 6.5-25 cm long, 1.3-1.7 cm wide, acute. Inflorescence erect or spreading, shorter than pseudobulb, peduncle 8-12 mm long; ovary with pedicel 1.6-1.7 cm long, subtended by an obovate-elliptic floral bract 1.1-1.2 cm long, 6-7 mm wide. Flowers dull yellow-green, lip yellow with orange-maroon speckles, column pale green. Sepals somewhat fleshy, acute; dorsal ovate-elliptic, concave, 12.5–13.5 mm long, 6–7 mm wide; lateral sepals ovate, 12.5-13.5 mm long, acute, mucronulate. **Petals** lanceolate, 12.5–13.5 mm long, 3.8–4.2 mm wide, acute, mucronulate. Lip 3-lobate, 10.5-12 mm long, ca. 7 mm wide when expanded; lateral lobes triangular-ovate, obtuse, erect-uncinate, emerging from the lower 1/3 of the lip; 1.2-1.5 mm long; midlobe ovateoblong-subquadrate, evenly tapering from base to apex, 5.8–6.2 mm long, 2–2.5 mm wide, apex subtruncaterounded; disc bearing a narrowly triangular farinose callus narrowing toward the midportion then thickening again. Column arcuate, 7.5–8 mm long, 3–4 mm wide; broadly winged near apex; column foot 2–2.5 mm long; anther smooth, 2.3–2.5 mm long. Capsule about 2.5 cm long.

Poorly known ecology, tropical lowland rain forests (e.g., La Selva Biological Station) to 900 m. Flowering November to February. Central Valley of Costa Rica; probably also Nicaragua and Honduras.

Four distinct members of the *M. rufescens* complex are treated separately here. *Maxillaria acutifolia* Lindl. is a small member with nearly cylindric pseudobulbs and a yellow to green flower with the lip containing a red stripe up the center. *Maxillaria hedwigiae* Hamer & Dodson is a species with a white to green flower and an orange lip. Finally, *M. dressleriana* is a species with ovoid pseudobulbs and brownish maroon flowers. *Maxillaria moralesii* has been accepted variously as *M. rufescens* Lindl., a larger-flowered species from South America. It is possible that plants of *M. moralesii* and *M. acutifolia* as accepted here are indistinguishable.

Maxillaria muscoides J. T. Atwood, Lindleyana 9:236. 1994. TYPE. Costa Rica, Cerros el Humo de Pejivalle in the zone of Turrialba, *Dodson 2526* (holotype: SEL). Figure 12A.

Plant small, somewhat moss- or brushlike, to about 10 cm tall, consisting of a tuft of small, few-branched canes appearing somewhat cespitose; rhizome elongate, to 2 cm between pseudobulbs, rooted only at the base, concealed by scale bracts. Roots less than 0.5 mm in diameter. Pseudobulbs conic, somewhat grooved, to about 1.2 cm long and 5 mm wide, subtended by 3-4 foliaceous bracts; apex 1-foliate. Leaves acicular, terete, articulate, 1-3.5 cm long, about 1.5 mm in diameter, the apex obtuse and apiculate. Inflorescence 1 per foliaceous or nonfoliaceous rhizome bract appearing on the nearly mature shoot; scapes to about 1 cm long; ovary with pedicel 2-2.5 mm long, exceeded by the subulate floral bract. Flowers pale yellow, apparently not opening broadly. Sepals dissimilar; dorsal ligulate, somewhat concave, 5-5.5 mm long, 1.2-1.8 mm wide, acute, dorsally keeled at the apex; lateral sepals triangular-falcate, attached to the column foot, 5 mm long, less than 2 mm wide, acute. Petals elliptic-lanceolate, slightly falcate, 4-4.5 mm long, about 1.2 mm wide, acute. Lip hinged to the column foot, recurved in natural position, when spread (difficult) 3-3.5 mm long, 2-2.2 mm wide, shallowly 3-lobate at about the middle; lateral lobes rounded and somewhat embracing the column; midlobe ovate, acute, dorsally keeled; callus lamellate connecting the lateral lobes, ending at or below the sinuses. Column short, less than 2 mm long excluding the anther; foot about 1.8 mm long; anther 1.5 mm in diameter; pollinia

4, supported on a short, squarrose stipe with dark viscidium (dried material).

Epiphytic in premontane rain forests at 1350 m. Flowering August to November. Endemic to Costa Rica; known only from Tapantí.

In habit *M. muscoides* is unlike any other species known from Central America, and the needle-like leaves are reminiscent of certain Brazilian taxa; however, these other taxa have two leaves at the pseudobulb apex. Flower morphology indicates a distinct relationship with Costa Rican *M. microphyton* Schltr. Its small size renders it unable to compete with more showy orchids for the eye of all but the most ardent collectors.

Maxillaria nasuta Rchb. f., Beitr. Orch. Centr.-Am. 104. 1866. TYPE: Colombia, Lasita (holotype: w; isotype: κ). Maxillaria nasalis Rchb. f., Saund. Ref. Bot. 2: t. 102. 1872. TYPE: Costa Rica, Endres 266 (holotype: w). Maxillaria brevipedunculata Ames & C. Schweinf. Sched. Orch. 10:91. 1930. TYPE: Costa Rica, Toro Amarillo, A. Alfaro 190 (holotype: US; photo of type: AMES). Figure 17D.

Plant a robust, cespitose epiphyte of larger branches and trunks in evergreen forests. Roots large, to 5 mm in diameter. Pseudobulbs smooth, appearing varnished, not forming ridges when dry, ovate, compressed, 5-7 cm long, 2.5-3.5 cm wide, subtended by several leaf-bearing rhizome bracts, apically 1-foliate. Leaves linear, with a long conduplicate petiole, 20-65 cm long from the articulation, 2–3.5 cm wide, acute to obtuse. Inflorescence 2 or more per rhizome bract, successively borne, covered by several blunt flaring sheaths; ovary about 3 cm long. Flowers with leathery segments, green to yellow, the lip mostly red. Sepals lanceolate to elliptic, 3.5-4.5 cm long, 1-1.2 cm wide, acute. Petals elliptic, oblique at the base, 2-3 cm long, 5-7 mm wide, acuminate. Lip basally rounded, 2 cm long, 1.5 cm wide, 3-lobate from just above the middle; midlobe triangular, reflexed, callus on the lower half oblong but poorly defined, papillose, and cushion-like. Column arcuate, 1-1.4 cm long, the anther cap with a dark spot on each side. Capsule ellipsoid, 5 cm long.

A large, clumping epiphyte of larger branches in wet forests at 150–1500 m in Central America; to 2000 m in Ecuador. Flowering April to October in Central America. Mexico to Bolivia.

Specimens from higher elevations in Costa Rica and Ecuador often exhibit larger-scape bracts than do those from lower elevations, but the variation is probably continuous.

Maxillaria neglecta (Schltr.) L. O. Williams, Ann. Mo. Bot. Gard. 29:348, Fig. 4. 1942. *Or-* nithidium neglectum Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:242. 1923. TYPE: Costa Rica, A. M. Brenes 164 ex R. Schlechter (pressed from cultivated material) (drawing of type: AMES). Not Scaphyglottis pendula Poeppig & Endl. sensu Brieger. Figure 9C.

Plant a straggly, usually somewhat pendent epiphyte often forming large clumps to about 50 cm across; rhizome elongate, concealed by bracts. Roots slender to 0.5 mm in diameter. Pseudobulbs cylindric, somewhat compressed, 1.8-3.5 cm long, 4-12 mm wide, spaced 1-5 cm apart, 1-foliate. Leaf chartaceous, linear to lanceolate, 7-20 cm long, 5-13 mm wide. Inflorescence a fascicle of scapes borne at the base of the most recently developed pseudobulb, the scapes much less than 1 cm long and concealed by the rhizome bracts; ovary 3-4 mm long. Flowers fleshy, white, the lip with yellow midlobe. Sepals concave and not opening widely, dorsal 5-6 mm long, 4-5 mm wide when flattened; lateral sepals about ½ connate, each obliquely ovate, 5-7 mm long, 4.5-5.5 mm wide. Petals narrowly oblong-ovate, slightly constricted on the upper half 4-5.5 mm long, 1-2 mm wide, the apex rounded and apiculate. Lip 3lobate, 4.5-6 mm long, 3-4 mm across when spread (difficult); lateral lobes broad, subquadrate, partially connected to the column foot and with straight or concave lateral margins; midlobe fleshy, ovate, and obtuse, ¼–⅓ the lip; with a transverse ridgelike callus at the base of the midlobe connecting the lateral lobes. Column stout, straight, 1.2-2 mm long excluding the anther; foot at the base about 2.5 mm long; anther globose, about 1 mm in diameter. Capsule globose about 6 mm long, 5 mm wide.

Epiphytic in tropical evergreen forests; often over water at 0–900(1600?) m. Flowering August to November; fruiting by January. Honduras to Panama; possibly also Colombia.

Maxillaria neglecta (sensu L. O. Williams, Ann. Missouri Bot. Gard. 29:348. 1942) has traditionally included plants segregated below as M. pseudoneglecta (based on Ornithidium anceps Rchb. f.). Maxillaria neglecta is a more widespread, usually lowland species and has generally much more narrowly linear leaves. It is readily distinguished from M. pseudoneglecta (occasionally white-flowered) by the narrower lateral lobes of the lip with essentially straight outer margin. When spread, the lip is a maximum of 4 mm across in M. neglecta and always (4.5)5-7 mm across in M. pseudoneglecta. Maxillaria neglecta is distinguished from M. brevilabia by its generally smaller, linear, and acute leaves; the latter species has elliptic, obtuse leaves. Inflorescences of M. brevilabia develop along the entire length of the recently matured rhizome, not just at the base of the pseudobulb as in M. neglecta.

Maxillaria nicaraguensis (Hamer & Garay) J. T. Atwood, Selbyana 10:60–62. 1988. Neourbania nicaraguensis Hamer & Garay, Icon. Pl. Trop. 13: t. 1238. 1985. TYPE: Nicaragua, Department of Chontales, A. H. Heller 7057 (lectotype: SEL; isolectotypes: SEL, AMES). Figure 4B.

Plant a straggly decumbent epiphyte lacking pseudobulbs but often forming large clumps; stems ascending, to about 20 cm tall, unbranched above and sheathed by the bases of 6-12 distichous leaves to 5 cm apart. Roots white, to 1 mm in diameter. Leaves 4-7.5 cm long and 5-8 mm wide, oblanceolate-oblong, somewhat unequally 2-lobate at the obtuse apex, articulated to the somewhat inflated rugose sheath. Inflorescence appearing singly or in pairs in the leaf axils, the peduncle plus ovary 1-2 cm long. Flowers creamy yellow marked with red. Sepals oblong-lanceolate, 8-9 mm long, 1.5 mm wide. **Petals** obliquely oblong-lanceolate, 6–7.5 mm long, 1.5-2 mm wide. Lip rigidly attached to the base of the column, oblong-pandurate, constricted in the middle, 5-8 mm long, 2-2.5 mm wide; basal half concave and parallel to the column; apical ½ reflexed and with a crenulate margin. Column arcuate, about 4 mm long; foot nearly absent. Capsule ellipsoid, about 1.25 cm long.

Epiphytic in larger branches of tree crowns of wet lowland forests at 50–900 m. Flowering November and December. Nicaragua and Costa Rica.

Although represented at La Selva Biological Station by a single collection, it is quite common there but probably rarely seen in flower. A short flowering period would account for the few collections having been made.

Maxillaria cf. obscura Lind. & Rchb. f., Beitr. Orchid.-K.C.Amer. 31–32, t. 6. 1866. TYPE: Colombia (including Panama). Figure 22B.

Plant a cespitose epiphyte to perhaps 20 cm tall. Roots white, to about 1.25 mm in diameter. Pseudobulbs compressed, ovoid to suborbicular, 1.5-4.5 cm long, 1-2.5 cm wide; base subtended by 1-2 subulate bracts with articulation but without definite blade; apex usually somewhat emarginate, 1-foliate. Leaves shortly petiolate (petiole < 1/5 blade); blade narrowly elliptic, 5-29 cm long, 1.2-2.9 cm wide, bluntly acute to obtuse and unequally 2-lobate. Inflorescence apparently 1 per bract axil of the mature shoots, to about 5 cm long; ovary with pedicel (1.6)1.8-2 cm long, trigonous, exceeded by a cucullate, acute floral bract. Flowers maroon to brown, or with sepals and petals yellow stained with maroon. Sepals similar, broadly oblanceolate to elliptic, acute; dorsal somewhat concave, 1.7–2.1 cm long, 5-6.5 mm wide; lateral somewhat oblique, 1.8-2.1 cm long, 5-6 mm wide. Petals broadly oblanceolate, 1.5-1.7 cm long, 4-5 mm wide, acute. Lip hinged to the column foot, recurved, 3-lobate below the middle, 1–1.2 cm long, 6–7 mm wide when spread; lateral lobes rounded and often slightly indented near the apex; midlobe ovate, fleshy, 6–7 mm long, about 4–4.5 mm wide, acute to obtuse and thickened near the apex; callus terminating at about the divergence of the lateral lobes, trapezoid, thickened in front, somewhat canaliculate toward the base. Column stout, arcuate, 5.5–7 mm long excluding the anther; foot 2–3 mm long.

Maxillaria cf. obscura grows in upper montane cloud forests at 1500–3000 m. Flowering November to May. Costa Rica and Panama.

This species, variously accepted as M. cucullata Lindl. (sensu lato) or M. atrata var. brachyantha Rchb. f., is restricted to southern Costa Rica and Panama. Maxillaria cf. obscura is unique among the M. cucullata Lindl. complex in southern Central America in the trigonous ovary, relatively short column, and trapezoid callus of the lip. It is also unique in the complex for its narrower petioles and smaller flowers, which are either dark maroon or have sepals and petals that are yellow stained with maroon. They are never lined with maroon dots as in M. punctostriata Rchb. f. Maxillaria cf. obscura is perhaps most closely related to M. lexarzana Soto & Chiang from Mexico but has smaller flowers with a shorter column. Also, that species flowers at the end of the rainy season (August to October), while this species flowers during the dry season.

The name *M. obscura* is based on a plant with its origin given as "Columbia," which included Panama at the time of publication. The relatively long midlobe of the lip apparent in the plate accompanying the original description matches the plants described here. No type specimen has been located.

Maxillaria oreocharis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:69. 1922. TYPE: Panama, Chiriquí, *Powell 256* (isotype: AMES). Figure 15C.

Plant a large, somewhat scandent epiphyte with ascending shoots 1–6 cm apart, with only the lowermost forming roots. Roots white, to about 1 mm in diameter. Pseudobulbs ovate, apically 1-foliate, strongly compressed laterally, 1.5–4 cm long, 1–2 cm wide, subtended by bladeless rhizome bracts (at maturity), the leaf articulation oblique. Leaves linear, shortly petiolate, the blade 13–30 (39) cm long, 5–15 mm wide, acute. Inflorescences 1 per each of several concealing rhizome bracts of the mature shoot, 1.5–2.5 cm long, with 3 or more acute sheaths; ovary with pedicel 2–2.5 cm long, far exceeding the subtending floral bract. Flowers complex in color, the sepals red exteriorly, pink interiorly, the petals white to yellow (yellowing with age?); lip red, the apical ½ yellow. Sepals narrowly ovate-lanceolate,

1.5–1.8 cm long, 4–5 mm wide, acute. **Petals** obliquely lanceolate, 1.2–1.6 cm long, 3–5 mm wide. **Lip** about 1.2 cm long, 6 mm wide when spread, hinged to the column foot, oblong, somewhat constricted at the base of the apical ½; apex fleshy, reflexed; callus ligulate, reaching to just beyond the middle. **Column** to about 10 mm long with anther; foot 2 mm long.

Epiphytic in wet forests at 100-1100 m. Flowering August to December (February). Nicaragua to Panama.

This species is easily distinguished from closely related *M. alba* (Hook. f.) Lindl. and *M. anceps* Ames & C. Schweinf. by the narrower, acute leaves and by the purple color in the somewhat smaller flowers, which are borne within the rhizome bract axils of mature shoots.

Maxillaria pachyacron Schltr., Repert. Spec. Nov. Regni Veg. 9:165. 1911. TYPE: Costa Rica, La Palma, A. Tonduz 9681 (isotype: AMES), Ingram & Ferrell 770 (epitype selected here: SEL). Figure 24B.

Plant epiphytic, cespitose, forming small clumps to about 12 cm tall. Roots to 1 mm in diameter. Pseudobulbs narrowly to broadly ovoid, 1-2 cm long, subtended by 1(2) leaf-bearing rhizome bracts, apically 1-foliate. Leaves distinctly petiolate, the petiole to about ½ the blade length and narrowed at the articulation; blade elliptic-ovate to linear, 5-20 cm long, 1.5-3.5 cm wide, acute, the apex often recurved. Inflorescence often reaching above the leaves, to 25 cm high; scapes wiry, nearly covered by 4-5 acute to obtuse, involute sheaths 1.5-2.5 cm long; ovary with pedicel lepidote, usually longer than the subtending bract, 2.3-3.5 cm long. Flowers spidery, the segments tan apically, whitish basally turning brown with age. Sepals lance-attenuate, 3.5-5 cm long; dorsal 3-4 mm wide; lateral sepals 4-5 mm wide near the base. Petals lanceolate, falcate, 2-3 cm long, 3 mm wide. Lip obovate, 1.3 cm long and 6-7 mm wide, 3-lobate on the apical 1/6; midlobe very fleshy, with a ligulate callus extended to just below 3/3 the lip, parabolic, thickened and elevated in front. Column arcuate, 1 cm long, including the 5-mm-long foot, anther bed papillose, pollinia 4, on a saddle-shaped viscidium. Capsule somewhat obovoid.

Common in cloud forests at 1000-1900 m. Flowering July to March. Nicaragua to Panama.

This species was synonymized by Ames under *M. reichenheimiana* Endres & Rchb. f., but that species has a longer mentum (chin) formed around the longer column foot besides the more obvious broader, white-spotted, and usually emarginate leaves. *Maxillaria arachnitiflora* Ames & C. Schweinf. is also similar but has more acuminate sepals, often spiraled near their apices, and a much longer column foot, and its floral bract ex-

ceeds the ovary. The similar *M. chionantha* J. T. Atwood has longer pseudobulbs, proportionately broader leaves, and a longer midlobe and grows at lower elevations.

The identification of M. pachyacron Schltr. is based on the original description and on the only known isotype (drawing), at Harvard. The drawing shows not only the small midlobe of the lip but also a broad leaf, suggesting that Schlechter constructed a monstrosity from different specimens, possibly representing different species. Because it could be confused with M. chionantha, an epitype is designated for clarification in the absence of other original material. As a further complication, a specimen with a label consistent with the collection data in the original description of M. pachyacron has surfaced at US, but the flower is clearly much smaller than that indicated in the description and has a very dissimilar lip. Furthermore, the plant has long rhizomes, whereas the original description indicates "rhizomate valde abbreviato." This plant is M. schlechteriana J. T. Atwood, and the label seems to have been combined with the specimen in error.

Maxillaria paleata (Rchb. f.) Ames & Correll, Bot. Mus. Leafl. 11:15. 1943. *Ornithidium paleatum* Rchb. f., Linnaea 41:36. 1877. TYPE: Central America (holotype: W). *Camaridium wrightii* Schltr., Repert. Spec. Nov. Regni Veg. 16:448. 1920. TYPE: Nicaragua, *Wright s.n.* (isotype: AMES). *Maxillaria wrightii* (Schltr.) Ames & Correll, Bot. Mus. Leafl. 11:18. 1943. Figure 13E.

Plant a straggly, pendent epiphyte, somewhat branched, to about 1 m long, anchored only at the base; successively borne shoots to 25 cm long, diminishing above, each consisting of a slender, wiry, scaly rhizome (cane) to about 4 mm in diameter terminated by a pseudobulb. Roots white, less than 1 mm in diameter. Pseudobulbs ovoid to orbicular, biconvex, 1-5 cm long, to 2.5 cm wide, subtended when young by 1-4 leaf-bearing rhizome bracts. Leaves 2-23 cm long, 0.5-4.5 cm wide; blades of rhizome bracts with a broad sheath, narrowing abruptly above the articulation to a slender petiole, the apex acute. Inflorescence short, lateral, single flowered, produced precociously on the canes of developing shoots; scapes to about 2 cm long; ovary with pedicel 6-9 mm long, subtended by a subulate bract 1.2-1.7 cm long. Flowers reddish purple. Sepals similar; dorsal oblanceolate, 1.6–2.1 cm long, 4–4.5 mm wide, acute; lateral sepals obliquely ovate, 1.6–2.1 mm long, 5 mm wide. Petals elliptic-lanceolate to oblanceolate, 1.5-1.8 cm long, to 5-5.5 mm wide. Lip more or less fixed to the column foot, 3-lobate just above the middle, 9-10 mm long, about 2.5 mm wide; base subsaccate; midlobe fleshy, papillose, sharply deflexed; callus fleshy, tonguelike at the base, ending at about the sinuses between lateral lobes. Column stout, straight, 3.5–4.5 mm long excluding anther; foot nearly obsolete, to about 1 mm long.

Epiphytic and terrestrial in montane forests at (900)1200–3000 m. Flowering July to March; probably throughout the year. Southern Nicaragua (Volcán Maderas) to Panama.

Maxillaria paleata is similar to M. minor (Schltr.) L. O. Williams but has much larger, magenta flowers. Most authors have accepted M. schlechteriana J. T. Atwood (as M. wrightii var. imbricatum (Schltr.) Ames & Correll) as a variety of what is accepted here as M. paleata. However, no hybrids are known in areas of sympatry between that entity with smaller, lighter lavender flowers and M. paleata.

A search for the type of *Ornithidium paleatum* at the Reichenbach Herbarium has shown that the name *M. paleata* has been misapplied to a similar species, *M. dichotoma* (Schltr.) L. O. Williams. The misapplication is based on a poor drawing of the lip, which is grossly similar to that of *M. dichotoma*, but reexamination shows the characteristic sigmoid shape consistent with *M. wrightii*.

Maxillaria parviflora (Poeppig & Endl.) Garay, Bot. Mus. Leafl. 21:258. 1967. Scaphyglottis parviflora Poeppig & Endl., Nov. Gen. ac Sp. 1:58, t. 1836. TYPE: Peru, Cuchero, Poeppig (holotype: w). Pseudomaxillaria parviflora (Poeppig & Endl.) Brieger, Bot. Jahrb. Syst. 97:555. 1977. Ornithidium confertum Griseb., Fl. Br. W. Ind. Isl. 626. 1864. TYPE: Trinidad; Cuba, Wright 650 (isotypes: GOET, USF). Maxillaria conferta (Griseb.) C. Schweinf. ex Leon, Contrib. Ocas. Mus. Hist. Nat. Coleg. de la Salle 8:395. 1946. Ornithidium chloroleucum Barb. Rodr., Gen. et Spec. Orch. Nov. 2:208. 1882. TYPE: Brazil. Pseudomaxillaria chloroleuca (Barb. Rodr.) Hoehne, Arquiv. Bot. Estad. S. Paulo 2:72. 1947. Maxillaria simulans Ames & C. Schweinf, Sched. Orch. 10: 99. t. 1930. TYPE: Guatemala, Tuerckheim 8302 (holotype: AMES). Figure 9D.

Plant a straggly rhizomatous epiphyte to about 40 cm across, rooted only at the lowermost shoots; rhizomes elongate, concealed by bracts, to about 4 mm in diameter. Roots white, rarely exceeding 0.5 mm in diameter. Pseudobulbs cylindric to ovoid, compressed, 1.5–4 cm long, 6–12 mm wide, spaced 1–7 cm along the rhizome, subtended by a pair of subulate nonfoliaceous bracts, apically 1-foliate. Leaf subcoriaceous, shortly petiolate, the blade lanceolate to linear, 9–20 cm long, 9–20 mm wide, acute. Inflorescences fascicled at the base of the most recently matured pseudobulb and usually with the

flush of new growth; scapes < 1 cm long and hidden by the rhizome bracts; ovary and pedicel 3.5–4.5 mm long. Flowers white to light yellow (apparently purplish in Jamaican populations) with orange-yellow lip. Sepals ovate, concave, carinate apically, acute; dorsal 4.5–7 mm long, 2–3 mm wide; lateral sepals ½ connate, 4.5–6 mm long, 2–3 mm wide. Petals ovate-elliptic, 3–4 mm long, 1.2–2.5 mm wide, acute. Lip fleshy, continuous with the column foot; blade deltate to 3-lobate, 2.5–4 mm long, 1.5–2.5 mm across when spread; side lobes somewhat erect; midlobe ovate and obtuse; callus at the base emarginate and a second, larger, emarginate callus in front continuous with the lateral lobes. Column stout, about 1.5 mm long excluding the globose anther. Capsules globose, 7–8 mm long.

An epiphyte of seasonally dry forests at 0–1100 m. Phenological data are lacking for Costa Rica, but in Chiapas to Honduras flowering specimens have been collected from September to November. As here interpreted, *M. parviflora* ranges from Southern Chiapas, Guatemala, Belize, and Honduras to Florida (USA), the Caribbean arc, and probably much of tropical South America. It seems oddly absent from mainland Nicaragua to Panama, but specimens exist representing Isla del Coco (Costa Rica), an island with floristic affinities in South America.

This is the smallest-flowered low-elevation species of the *M. neglecta* complex, which is characterized by partially connate lateral sepals. It is easily distinguished by the nearly absent mentum and by the cuneate lip, which lacks the broad lateral lobes seen in *M. neglecta* and *M. pseudoneglecta*.

Maxillaria parviflora from South America probably includes Ornithidium rhomboglossum Schltr., M. exigua Regel, and M. surinamensis Focke ex Rchb. f. as synonyms.

Maxillaria parvilabia Ames & C. Schweinf., Sched. Orch. 8:62–64. 1925. TYPE: Costa Rica, Province of San José, La Palma, *Standley* 32939 (holotype: AMES; isotype: US). Figure 4D.

Plant an epiphyte often more than 1 m tall; rhizomes forming upright or decumbent, often much-branched, leafy canes to 1 cm in diameter lacking pseudobulbs (apparently also as juveniles), concealed by imbricate sheaths. Roots mostly at the base but also along the canes, to about 1.2 mm in diameter. Pseudobulbs apparently absent in juvenile shoots. Leaves distichous, often with persistent blades restricted near the stem apex, the sheath minutely rugose and yellowish in dried specimens; blade deciduous, coriaceous, linear, 3.5–14 cm long, 8–15 mm wide, the base narrower than the sheath, the apex unequally 2-lobate. Inflorescences 1–several per leaf sheath; scapes 2–4 cm long, mostly concealed by acute, involute sheaths; ovary with pedicel 6–8 mm long exceeded by the subtending floral bract.

Flowers very fragrant, clear or light yellow, lip marked with red. Sepals dissimilar; dorsal elliptic, 1.4–2 cm long, 4–5 mm wide, acute; lateral sepals falcate-lanceolate, 1.3–1.9 cm long, 4–5 mm wide, acute. Petals elliptic-oblanceolate, 1.2–1.7 cm long, 4–4.5 mm wide, acute. Lip hinged to column foot, 5–6 mm long, 3–3.5 mm wide when spread, cuneate at the base, 3-lobate above the middle; lateral lobes rounded and clasping the column; midlobe rounded to subtriangular; callus low, fleshy, ligulate ending below the middle. Column straight, 2–2.5 mm long excluding the anther; foot about 2 mm long.

Epiphytic and common in cloud forests at 1200–2300 m, particularly in wind gaps; otherwise, little is known of its ecology. Flowering November to March. Mostly along Continental Divide in Costa Rica and western Panama.

Among similar cane-forming species, this one is unique in its small lip-to-dorsal sepal ratio (< ½) and the yellow and very fragrant flowers.

Maxillaria piestopus Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:302. 1923. TYPE: Costa Rica, San Ramón. *Tonduz s.n.*, May 1913 (destroyed), *Lankester 1213* (neotype selected here: AMES 34211). Figure 19C.

Plant a cespitose, erect epiphyte to 11 cm tall. Roots to 1.5 mm in diameter. Pseudobulbs suborbicular, about 1.2 cm tall, subtended by apparently nonfoliaceous bracts; apex 1-foliate. Leaves oblanceolate, erect, obtuse, sessile, 8-9 cm long, 1.1-1.3 cm wide. Inflorescence erect, subequal to the flower, produced at the base of immature shoots; peduncle about 5 cm long, compressed, with 4-5 large, triangular, obtuse sheaths; ovary with pedicel 2.5-2.8 cm long, triquetrous, about as long as the floral bract. Flowers pale yellow; lip with red spotting. Sepals dissimilar, dorsally carinate, 1.7-2 cm long; dorsal oblong, with somewhat dilated, obtuse to rounded apex; lateral sepals oblique at the base, narrowly oblong, subacute. Petals oblanceolate to spatulate, 1.2-1.3 cm long, rounded. Lip hinged to the column foot, 1.3-1.6 cm long, 7-10 mm broad when spread, distinctly 3-lobate at about the middle; lateral lobes small, obtuse; midlobe suborbicular to obovate, apparently without callus. Column slender, semiterete, arcuate, about 1 cm long, foot perhaps 2 mm long.

Apparently very rare; known only by a photograph of the holotype and by the neotype. Probably epiphytic, but nothing is known of its ecology. The type was collected in flower in May. Endemic to Costa Rica; the Lankester specimen was collected in Orosi.

Maxillaria piestopus is (or was) a distinct species with a unique oblanceolate leaf and large, triangular bracts of the scape (dried specimens), which are characteristic of no other species

known from Costa Rica. Also, the triquetrous ovary, oblanceolate petals, and large midlobe of the lip are unique. This species seems most similar to a Bolivian species described as *Mormolyca fuchsii* J. T. Atwood, which has similar scape bracts, a winged ovary, and otherwise similar flowers. It is possible that *Maxillaria piestopus* belongs with *Mormolyca*.

The above description is condensed from Schlechter's original and augmented by measurements taken from the neotype. The photograph of the destroyed holotype is rejected as a neotype because the photograph is not part of the original collection and cannot be dissected. The photograph, however, shows a drawn dissection showing Schlechter's concept of *M. piestopus* that is consistent with the neotype.

Maxillaria pittieri (Ames) L. O. Williams, Ann. Missouri Bot. Gard. 29:349. 1942. *Ornithidium pittieri* Ames, Sched. Orch. 2:36–37. 1923. TYPE: Costa Rica, San Isidro de Heredia, *Pittier 14048* (holotype: AMES; isotype: US). Figure 6B.

Plant a branched, somewhat straggly, mostly pendent epiphyte to nearly 2 m long; each shoot 10–15 cm long; stems somewhat curved. Roots mostly on the lower shoots where anchored, to 5 mm in diameter. Pseudobulbs lacking. Leaves 4–8 clustered near the stem apex, articulate to the sheath; blade coriaceous, very narrowly elliptic, 6-18 cm long, 1-2.2 cm wide, conduplicate at the base, somewhat concave apically, acute. Inflorescences densely aggregated at the base of completed shoots, the scapes about 2 cm long and hidden by the leaf bases; ovary with pedicel 1-1.4 cm long. Flowers mauve to pink, sometimes spotted with crimson, the lip apex yellow to green. Sepals similar, ovate, somewhat fleshy toward the apex, 7-9 mm long, 3.5-5 mm wide, acute to obtuse. Petals obovate, similar to the sepals, 6-7 mm long, 2.5–3.5 mm wide. Lip simple, rigidly adnate to the column foot, 4-5 mm long, 2.5-3 mm wide; apical half somewhat reflexed and quite fleshy, with a fleshy, bifid callus at about the middle. Column stout, straight, 2.5-3 mm long without the anther; foot 2.5-3 mm long, swollen apically; anther about 1 mm in diameter.

Apparently an uncommon epiphyte of cloud forests at 1500–2500 m. Flowering September, November, January, and May. Costa Rica and Panama.

Maxillaria pittieri differs from similar M. fulgens (Rchb. f.) L. O. Williams by its lack of pseudobulbs, usually somewhat curved stems, and somewhat larger, mauve to pink flowers (orange to red in M. fulgens) produced at the base of the most recently completed shoot. Flowers of M. fulgens are produced precociously within the bud scales of a developing shoot.

Maxillaria cf. planicola C. Schweinf., Bot. Mus. Leafl. 8:188. 1940. Based on *Camaridium latifolium* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:74. 1922. TYPE: Panama, on hills near Panama City, *Powell 8* (lectotype: AMES; isolectotype: AMES). Figure 11A.

Plant poorly known, a rhizomatous epiphyte; rhizome segments about 15 cm long between pseudobulbs, concealed by imbricate, incurved bracts. Roots to about 1 mm in diameter. Pseudobulbs lance-ovoid, strongly compressed laterally, about 7 cm long, 2 cm wide; base concealed by nonfoliaceous sheaths; apex 1-foliate. Leaf shortly petiolate; blade thin, elliptic, 22-32 cm long, 5-6 cm wide, acute. Inflorescences 2 or more per rhizome bract of apparently immature shoots (mature fide Fl. Pan.); ovary 1–1.5 cm long. Flower large, white, the lip with yellow (spots?) on the lower half. Sepals narrowly elliptic, 3-3.5 cm long, 7.5-9 mm wide, acute; lateral sepals somewhat oblique. Petals ligulate, somewhat oblanceolate, about 3 cm long, 6 mm wide, acute to obtuse. Lip attached to the column foot, 3-lobate on the upper half, the lower half curved in such a way as to form an extra pair of more obscure lobes, about 1.5 cm long and 1.5 cm wide when spread; lateral lobes embracing the column, rounded; midlobe ovate, rounded, reflexed; callus a thick, fleshy ligule ending at about the middle, with variously furcate hairs on the lower 3. Column arcuate, about 11 mm long excluding the anther, with nearly obsolete foot at the base. Capsule ellipsoid-ovoid, about 4 cm long.

Primary forests below 450 m. Panama and Costa Rica (Río Agua Buena, Rincon de Osa).

The single Costa Rican collection with two available duplicates (*Liesner 2010* at MO, SEL) exhibits fruit only but is most likely the above species. Both specimens show the elongate rhizome covered by incurved bracts, nonfoliaceous sheaths, and laterally much flattened, 1-foliate pseudobulbs characteristic of *M. planicola*. Also, the broad leaf at the pseudobulb apex, inflorescence size, and fruit with persistent column are consistent with that species. The above description of the flower is based on analysis of the isolectotype (AMES).

Maxillaria ponerantha Rchb. f., Bonplandia 2: 17. 1854. TYPE: Venezuela, around Caracas, *Wagener s.n.* (holotype: W). Figure 7E.

Plant small, to about 20 cm tall, somewhat straggly with ascending, leafy shoots 1–2 cm apart and rooted only at the base. Roots white, to about 0.5 mm in diameter. **Pseudobulbs** apically 1-foliate in Costa Rican material (2-foliate in the type description), oblong, com-

pressed, to 1.5 cm long and 5 mm wide, subtended when young by 3 or more leaf-bearing, rugose sheaths. Leaves oblong, 1-2.5 cm long, 2.5-6 mm wide, apically unequally bilobed. Inflorescence 1 per rhizome bract axil of the immature shoot; scape about 5 mm long covered by 2 or more acute scape bracts to 7 mm long and hidden from view by the rhizome bracts; ovary with pedicel slightly exceeding the subtending floral bract, 7–8 mm long. Flowers dark purple in Costa Rican material. Sepals elliptic-oblong, dorsally carinate apically, 8 mm long, 2.5 mm wide, acute. Petals linear-oblong to oblanceolate, 6 mm long, 1.5 mm wide, obtuse. Lip hinged to the column foot, narrowly obovate, slightly 3-lobate, the constriction at the final ½ forming the large midlobe, margin minutely papillose; callus fleshy, oblong, thickened and rounded in front, to about ½ the lip. Column arcuate, somewhat broadened apically, about 5 mm long; foot about 1.5 mm long.

Epiphytes forming dense colonies in premontane rain forests to about 700 m. Flowering June to September. Northern South America and Costa Rica (Puntarenas).

Plants conform to the type description of M. ponerantha, but the flowers are much darker in color and similar to a photograph of a plant from Surinam published by M. C. M. Werkhoven (Orchids of Surinam, p. 156. 1986) under the same name. Also, the pseudobulbs in Costa Rican material are apically 1-foliate, not 2-foliate. A lowelevation species, it is expected to exhibit a broad geographic range. Plants have often been misidentified as M. foliosa Ames & C. Schweinf. (= M. acervata Rchb. f.), but that species is somewhat larger, has apically 2-foliate pseudobulbs (in Costa Rican material), has slightly larger light green flowers with a reddish lip, and occurs in cloud forest regions at more than 1000 m. The difference in elevation preference between these two species doubtless provides them with little opportunity for hybridization.

Maxillaria pseudoneglecta J. T. Atwood, Lindleyana 8:30–31. 1993. *Ornithidium anceps* Rchb. f., Beitr. Orchid. -K.C. Amer. 75–76. 1866. TYPE: Costa Rica, Cartago, *Wendland s.n.* (holotype: w). *Not Maxillaria anceps* Ames & C. Schweinf. 1930. Figure 10B.

Plant a straggly, somewhat pendent epiphyte forming loose clumps, rooted only along the basal shoots; rhizome elongate, to 6 mm in diameter. Roots rarely more than 0.5 mm in diameter. Pseudobulbs cylindric to ellipsoid, rarely globose, compressed, 1.5–3 cm long, 0.7–1.8 cm wide, spaced 1–8 cm apart, subtended by a pair of subulate bracts, apically 1-foliate. Leaf shortly petiolate; blade lanceolate, 5–15 cm long, 1–2.8 cm wide, acute. Inflorescence a fascicle of single-flowered scapes at the base of the most recently matured pseudobulb;

scapes less than 1 cm long, concealed by the rhizome bracts; ovary and pedicel 4.5-6 mm long, concealed by inflated bracts. Flowers variously yellow (lip with orange midlobe), entirely orange, or white and lip with orange midlobe. Sepals concave and not well spread; dorsal oblong-ovate, 5.5-7.5 mm long, 2.2-3.5 mm wide, apiculate; lateral about ½ connate, more or less obliquely ovate, apiculate, 5-9 mm long, 4-5 mm wide. Petals oblong, constricted on the upper half, 4-6.5 mm long, 1.5-2 mm wide, obtuse. Lip continuous with and not distinct from the column foot, 3-lobate, 5-7 mm long, (4.5)5–7 mm across the lateral lobes when spread; side lobes deep with convex lateral margins; midlobe fleshy, triangular-ovate, occupying about 1/4 the lip, with a transverse ridgelike callus at the base of the midlobe connecting the lateral lobes. Column stout, 1.5-2 mm long excluding the anther; anther globose, about 1 mm in diameter.

Epiphytic in premontane and montane forests at (500?)900–2200 m. Most seem to occur in evergreen forests, but plants growing in semideciduous forests with *Plumeria rubra* and *Cattleya skinneri* are known. Flowering June to September. Costa Rica (Cordillera de Tilarán) to Boquete, Panama.

Maxillaria pseudoneglecta is most similar to M. neglecta but has statistically larger flowers. Also, the lip has much broader lateral lobes with convex margins, and the leaves are broader and more lanceolate.

Maxillaria punctostriata Rchb. f., Linnaea 41:
23. 1877. TYPE: Costa Rica, Low s.n. (holotype: w). Maxillaria rubrilabia Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:236. 1923.
TYPE: Costa Rica, San Ramón, 1050 m, Brenes 151 (destroyed); Todzia 334 (neotype: F). Figure 22C.

Plant a cespitose epiphyte to about 30 cm tall. Roots white, to about 1.5 mm in diameter. Pseudobulbs compressed, ovoid to suborbicular, 2.5-6 cm long, 2-3 cm wide; base subtended by nonfoliaceous, subulate bracts; apex 1-foliate. Leaves indistinctly to shortly petiolate (<\% blade); blade narrowly elliptic, 10-25 cm long, 2-4 cm wide; apex obtuse, emarginate, and apiculate. Inflorescence 1 or more per rhizome bract axil; to about 10 cm long; ovary with pedicel 1.8–2.4 cm long, terete, exceeded by a cucullate, acute floral bract. Flowers yellow to orange with lines of small purple dots; lip deep maroon. Sepals similar, broadly oblanceolate to elliptic, acute; dorsal somewhat concave, 2.2-2.7 cm long, 6.5-8.5 mm wide; lateral sepals somewhat oblique, 2.1–2.7 cm long, 6-8.5 mm wide. Petals broadly oblanceolate, 1.6-2.1 cm long, 6-7 mm wide, acute. Lip hinged to the column foot, recurved, 3-lobate below the middle, 1.2-1.8 cm long, 7-8 mm wide when spread; lateral lobes rounded; midlobe ovate, fleshy, 8-10 mm long, 6-7.5 mm wide, acute to obtuse and thickened near the apex; callus terminating at about the divergence of the

lateral lobes, oblong to somewhat trapezoid, thickened in front. **Column** stout, arcuate, 9–11 mm long excluding the anther; foot 3–4 mm long. **Capsule** about 4.5 cm long.

Common in evergreen to semideciduous cloud forests at 1100–2400 m. Flowering March to August and November; fruiting in July. Costa Rica; possibly in northern Nicaragua masquerading under the name *M. cucullata* Lindl. owing to the need for a revision of the *M. cucullata* complex.

At least three species of the M. cucullata Lindl. complex occur in Costa Rica, this one with yellowish sepals with maroon dots arranged in lines and a nearly black lip, another (M. cf. obscura Lind. & Rchb. f.) with much smaller maroon or vellowish flowers tinted with maroon, and a third recently described as M. cedralensis J. T. Atwood & Mora de Retana with larger, cream flowers. If the painting and presumably the type of M. cucullata (from Mexico) showing a long peduncle and a yellow flower stained with purple is accurate, this species probably does not occur in Costa Rica. There is little doubt that the name M. punctostriata applies to Costa Rican material that match the above description. The neotype of M. rubrilabia matches M. puntostriata very well and is here accepted as a synonym.

There may be a fourth species in the north with larger yellow to orange flowers with a very large, inflated floral bract concealing the ovary. A specimen (*Mora 60*, INB) collected at Estación Cacao at 1100 m, Cordillera de Guanacaste, and Cantón de Liberia appears to be *M. mombachoensis* Heller ex J. T. Atwood, which was originally described from adjacent southern Nicaragua, or it may be new. The dried plant has rather thick leaves and a short scape, suggesting a relatively dry or windy cloud forest habitat. (See Addendum.)

Maxillaria quadrata Ames & Correll, Bot. Mus. Leafl. 6:16. 1943. *Ornithidium lankesteri* Ames, Sched. Orch. 4:52–53. 1923. TYPE: Costa Rica, San Cristobal, *Lankester & Sancho 421* (holotype: AMES). Figure 5B.

Plant a large, monopodial, cane-forming epiphyte or terrestrial to about 1 m tall, probably becoming pendent with size; juveniles unknown, but probably cespitose with each shoot terminating in a pseudobulb; mature stems sheathed with closely spaced, conduplicate leaves, mostly deciduous near the base with sheaths fragmenting into fibers. Roots slender, to about 1 mm in diameter. Pseudobulbs unknown; absent on mature stems. Leaves articulate, coriaceous, keeled beneath, shortly petiolate above the articulation, the blades 5–18 cm long, 1–2.8

cm wide, the apex unequally 2-lobate. Inflorescences several-many per leaf axil; scapes to about 10 cm long, not much exerted beyond the subtending leaf blade, clothed in acute sheaths; ovary with pedicel about 1.2 cm long, usually exceeded by the subtending floral bract. Flowers with somewhat recurved segments, pink to white. Sepals similar, oblong-oblanceolate, 1.7-1.9 cm long, 4-5 mm wide, the apex acute. Petals elliptic-oblanceolate, 1.2-1.5 cm long, 3.5-4.5 mm wide, apex acute to acuminate. Lip rigid with the column foot, more or less straight and not saccate on the lower ½, 3-lobate above the middle, 4-5 mm long, 2.5-3 mm wide in natural position; lateral lobes well extended beyond the sinuses, rounded; midlobe ovate, rounded to emarginate, recurved; callus a truncate ligule ending just below the lobe sinuses, with an additional 3 or more papillae at the base. Column stout, 3-4 mm long excluding the anther; the anther about 1.5 mm in diameter.

Maxillaria quadrata appears to be a rare epiphyte or terrestrial in montane cloud forests at 1500–1900 (2400) m. Flowering December to March. Endemic to Costa Rica; to be expected in western Panama.

From its closest relative, *M. adolphii* Ames & Correll, it differs by its occurrence at lower elevations and by its more or less straight, nonsaccate lip with more elongate lateral lobes, which usually are concave, embracing the column.

Some herbarium specimens from upper elevations (to 2400 m) may actually represent hybrids of *M. adolphii* with *M. biolleyi* (Schltr.) L. O. Williams. The latter species as a potential parent would explain the relatively straight, simple lip in flowers that otherwise appear similar to flowers of *M. quadrata*.

Maxillaria ramonensis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:235. 1923. TYPE: Costa Rica, Santiago de San Ramón. *Brenes 154* (lectotype: CR; isolectotype: AMES). *Maxillaria brevipes* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:302. 1923. TYPE: Costa Rica, La Palma, *Wercklé 110* (photo of type: AMES). Figure 23D.

Plant a cespitose epiphyte forming small clumps 6–20 cm tall. Roots filiform, white, to 0.5 mm in diameter. Pseudobulbs approximate, ovoid to suborbicular, 1–2 cm long, to about 2 cm wide, subtended by nonfoliaceous bracts, or with a single foliaceous bract, the apex 1-foliate. Leaves long-petiolate; sheath of foliaceous bracts much broader than the petiole; petioles canaliculate, 1–4 cm long, to about ½ the blade length; blade well defined, narrowly to broadly elliptic, rarely somewhat oblanceolate, acute to subattenuate apically. Inflorescences 1 or more per rhizome bract, the scape 1–3.5 cm long; ovary with pedicel 1–1.2 cm long, exceeded by the acute floral bract. Flowers apparently not opening

broadly; sepals and petals translucent cream-white with white veins aging reddish or brownish; lip white strongly suffused with red, the apex usually dark red. Sepals dissimilar; dorsal oblong-ovate, 9-12 mm long, 4.5-5.5 mm wide with obtuse, mucronate apex; lateral sepals inserted on the column foot, oblique, triangular, 1.5-1.8 cm long, 5-7.5 mm wide with bluntly acute to obtuse apex. Petals oblique at the base, ligulate to ovate, acute, 1-1.3 cm long, 3.5-4.5 mm wide; apex acute to obtuse. Lip hinged to the column foot, cuneate from the base, the apical $\frac{1}{5}$ - $\frac{1}{3}$ 3-lobate, 1.1–1.3 cm long, 5–6.5 mm wide when spread; lateral lobes rounded to somewhat angular in front and embracing the column; midlobe ovate, rounded in front. Column stout, arcuate, 4-5 mm long excluding the anther; foot 8–9 mm long; anther 2– 2.5 mm in diameter; pollinia 4, supported on a squarrose

Epiphytic in premontane and lower montane rain forests at 500–1200(1500) m. Flowering May to December. Nicaragua to Panama; also reported from Honduras.

Maxillaria ramonensis lacks the fringed anther bed seen in M. confusa and has a much more stout column and a longer column foot than flowers of either M. brachybulbon Schltr. or M. acostae Schltr. Maxillaria brevipes is here interpreted as a small M. ramonensis. Both names are based on plants with stout columns and long column feet. The above description includes forms from Panama with a long midlobe and may prove to represent a different species.

Maxillaria reichenheimiana Endres & Rchb. f., Gard. Chron. 1678. 1871. TYPE: Costa Rica, M. Endres (holotype: w). Figure 24A.

Plant epiphytic, cespitose, forming small clumps to about 15 cm tall. Roots to about 1 mm in diameter. Pseudobulbs about 1-2 cm long, orbicular to ovoid, compressed, usually hidden by subtending bracts, 1(2) of which may bear a leaf blade. Leaves shortly and distinctly petiolate, the blade round to elliptic, 4.5–11 cm long, 2-4.5 cm wide, apically emarginate to obtuse and very rarely acute. Inflorescences usually held above the leaves, the scapes 5(2)-8 cm long, nearly concealed by 4-6 acute to obtuse bracts 1-2.5 cm long; ovary with pedicel shorter than the subtending floral bract, lepidote, 1.5-2.5 cm long. Flowers spidery, pale yellow aging brown. Sepals lanceolate, acuminate, 3-4 cm long; dorsal sepal 2.5 mm wide; lateral sepals 4 mm wide. Petals falcate, lanceolate, about 2.5 cm long, 4 mm wide, attenuate. Lip obovate, the apical 1/6 3-lobate, 1.3 cm long, about 6 mm wide; midlobe fleshy; callus ligulate, to just below 3/3 the lip, parabolic, thickened, and somewhat elevated in front. Column 1.2 cm long including the 8 mm-long foot; anther bed papillose, pollinia 4, with saddle-shaped viscidium.

Epiphytic in premontane and lower montane rain forests at 1000-1500 m. Costa Rica south to

Venezuela and Ecuador. Flowering April to September. Reports from Nicaragua are most likely based on *M. pachyacron*.

Maxillaria reichenheimiana is readily distinguished from M. pachyacron by its broad, usually emarginate leaves with white spots. The flowers of both species are remarkably similar, but the sepals of M. reichenheimiana are usually shorter, and the column foot is distinctly longer. Both species are sympatric over parts of the range, e.g., at Monteverde, Costa Rica. Both species are isolated phenologically because M. pachyacron flowers from October to March.

Maxillaria ringens Rchb. f., Ann. Bot. Syst. 6: 523. 1863. TYPE: Costa Rica, Endres 8 (lectotype selected here: w). ?M. yzabalana S. Watson, Proc. Amer. Acad. Arts 23:266. 1888. M. tuerckheimii Schltr., Repert. Spec. Nov. Regni Veg. 10:295-296. 1912. TYPE: Guatemala, Cubilguitz, von Türckheim 790 (drawing of type: AMES). M. rouseauae Schltr., Beih. Bot. Centralbl. 36(2):413-414. 1918. TYPE: Panama, "Im Gebiete des Panama-Kanals," Rouseau s.n., Powell 115 (neotype selected here: мо 955962). M. pubilabia Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:70-71. 1922. TYPE: Panama, "Auf Hügeln bei Panama City," Powell 214 (lectotype: AMES; isolectotype: MO). M. amparoana Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:54-55. 1923. TYPE: Costa Rica, Carillo, Wercklé 7. M. lactea Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:233. 1923, not 1925. TYPE: Costa Rica, San Mateo, Brenes 143 (isotype: AMES). Figure 20A.

Plant an often densely cespitose epiphyte to about 50 cm tall. Roots to about 1 mm in diameter. Pseudobulbs ovoid, not much compressed laterally, rugose or sometimes furrowed, 3-6 cm long, 1.5-3 cm wide, subtended by nonfoliaceous sheaths lacking articulations and soon fragmenting with age, apex 1-foliate. Leaves with distinct, canaliculate petiole to 10 cm long; blade ellipticoblong, carinate and somewhat glaucous beneath, 11.5-38 cm long, 2-4.5 cm wide, the apex bluntly acute to rounded. Inflorescences several per rhizome bract; scape 3-13 cm long, concealed by bracts; ovary with pedicel (1.2)2-3.7 cm long. Flowers white, the sepals yellow within, aging pinkish or tan; lip white with yellow callus, usually with purple veined lateral lobes and spots on midlobe. Sepals somewhat chartaceous and canaliculate, straight, oblong, with apex acute to obtuse or acuminate; dorsal 2.5-4 cm long, 4-6 mm wide; lateral sepals 2.7-4.2 cm long, 4.5-7 mm wide. Petals narrowly lanceolate, incurved, 2.5-4 cm long, 3-5 mm wide. Lip ovate in general outline, (0.9)1.1–1.5 cm long, (4)6-8.5 mm wide when spread, 3-lobate on the apical 1/4; side lobes embracing the column, obtuse; midlobe fleshy, warty, and suborbicular. Column stout, clavate, nearly straight, 6.5–8 mm long excluding foot or anther; foot 4–5.5 mm long; anther about 2 mm long, with a dorsal crest. Capsule ellipsoid, 3–4.5 cm long.

Epiphytic at (100)300–1600 m. Flowering August to November in Costa Rica, July to December in Panama, and June to September in Nicaragua to Mexico. Mexico to Panama with doubtful reports from Colombia (probably *M. brunnea* Linden & Rchb.f.).

Maxillaria ringens is here interpreted as a variable species. It is characterized by the often large, cespitose plants with strongly fragrant clusters of white flowers with narrow segments. Schlechter recognized various entities based on scape length, the presence or absence of hairs on the lip, and flower color. Under apparently different cultural conditions, singular clones at Selby Gardens sometimes exhibit the long scapes of M. ringens or the short scapes of M. amparoana. Finding hairs on the lip probably depends on the quality of the microscope because they were observed in virtually all rehydrated flowers (n = 10) broadly sampled among available specimens. Flower color ages pinkish or tan, and color descriptions by collectors are by no means uniform. In Costa Rica, live specimens collected from upper elevations are somewhat smaller, have smoother pseudobulbs, and may be different. One specimen at CR (Robinson & Vaughn 1243) with somewhat larger flowers and long scapes had flowered in April and may be M. fuerstenbergiana Schltr., a species unknown from Central America.

There has been some confusion concerning the application of the name *M. ringens*. Reichenbach's original description indicates "labello sepalis ter breviore," or lip one-third as long as (three times shorter than) the sepals. This phrase excludes *M. brunnea*, in which the lip is at least half as long as the sepals.

Although no original materials were found of *M. rousseauae*, the designated neotype is so identified by Schlechter.

Maxillaria rodrigueziana Atwood & Mora-Retana, Icon. Pl. Trop. 14: t. 1361. 1989. TYPE: Panama, El Cope, *T. Antonio 2137* (holotype: MO; isotype: SEL). Figure 23A.

Plant a large, cespitose epiphyte, to 35 cm high. Roots white, to 1 mm in diameter. Pseudobulbs ovoid, rugose, 1-foliate, 4–5 cm long and 3–4 cm wide, subtended and often hidden from view by the inflated bladebearing rhizome bract base, which is usually abruptly

narrowed at the articulation. Leaf blades coriaceous, elliptic, obtuse to rounded, 18-30 cm long, 4.5-8 cm wide, supported by a long petiole 5-15 cm long. Inflorescences 14-20 cm tall, mostly hidden by 4-7 inrolled, obtuse bracts 2-6.5 cm long; ovary with pedicel about 2.5 cm long, concealed by the conspicuous, conduplicate, acute floral bract 5-8 cm long. Flowers creamy white, fragrant, the sepals turning greenish toward the apex, lip base white, apically yellow, and lined on the sides with red. Sepals long attenuate, 12-16 cm long with the dorsal slightly shorter than the lateral sepals, 1.0–1.3 cm wide at the base. **Petals** long-attenuate, 10-14 cm long, 7-9 mm wide at the base. Lip ovate, 3-lobate on the apical ¼, about 2 cm long and 1.5 cm wide; midlobe broadly rounded and somewhat reflexed; lateral lobes folded and embracing the column; callus ligulate, puberulent, to about the ½ the lip. Column cylindric, about 1.5-1.8 cm long, forming a foot 8 mm long at the base; pollinia 4, lacking a stipe but supported on a saddle-shaped viscidium.

Large and apparently rare epiphyte in evergreen forests at 700–750 m. Flowering June, October, and November. Costa Rica and Panama.

This species is one of the most spectacular Central American maxillarias and is unique for its sheer size. It is easily distinguished from its South American sister species, *M. speciosa* Rchb. f., by the more leathery flowers and by the spotting on the sepals and petals restricted to the lower half. The midlobe of the lip is less than a quarter the lip length in this species and nearly half the lip length in *M. speciosa*. One might regard it as a subspecies of *M. speciosa*, but the consistently different features mentioned argue for recognition of two distinct species. According to R. L. Dressler, *M. rodrigueziana* has a heavy fragrance of cheap perfume that is a bit much in close quarters.

Maxillaria sanguinea Rolfe, Bull. Misc. Inform. 1895:8. TYPE: Panama, Chiriquí, *James O'Brien s.n.* (holotype: к). Figure 10E.

Plant epiphytic with short to somewhat elongate rhizomes forming large clumps. Roots white, to 1.5 mm in diameter. Pseudobulbs 0.5-4 cm apart, fusiform-ellipsoid, apically 1-foliate, usually tapering at both ends, 1-2.5 cm long, 0.5–1.3 cm broad. Leaves linear, 20–35 cm long and 2-3.5 mm wide. Inflorescence 1 per rhizome bract on the rhizome of the most recently completed shoots; scapes about 1 cm long, nearly concealed by the rhizome bract and covered by scape bracts; ovary with pedicel 2-3.5 cm long. Flowers slightly fragrant, the perianth greenish with strong overlay of red, lip flushed with red, apically white; callus maroon. Sepals oblong-elliptic, 1.8-2.7 cm long, 4-9 mm wide, the lateral sepals forming a mentum around the column foot. Petals somewhat falcate and arcuate, 1.5-2.3 cm long, 3.5-7 mm wide. Lip obovate, apically obtuse to truncate, laterally constricted on the apical 1/3, rendering it somewhat 3-lobate, 1.5-2.0 cm long, 6.5-9.5 mm wide; callus ligulate on the lower ½, apically recurved, truncate. Column arcuate, 1.1–1.5 cm long; anther cap papillose; pollinia 4, supported on a saddle-shaped viscidium.

Epiphyte of larger branches in lowland tropical and premontane rain forests at 10–900 m. Flowering January and February. Costa Rica and western Panama; erroneously reported from Florida (USA), apparently on the basis of a specimen planted in the wild (fide J. Beckner, pers. comm.).

Maxillaria sanguinea is similar to M. tenuifolia, which it replaces geographically. The latter species, ranging from Mexico to Nicaragua, flowers from March to May, while M. sanguinea flowers in January and February. The flowers of M. tenuifolia have a pronounced fragrance resembling coconut (or crayons), whereas M. sanguinea has a slightly fruity fragrance. The lip apex is broader in M. sanguinea and is usually white, at least apically, and only minutely spotted (peppered). The lip apex of M. tenuifolia is always conspicuously spotted with a few large blotches. Vegetatively, M. sanguinea usually has fusiform pseudobulbs, while those of M. tenuifolia are usually cylindric. The leaves of *M. sanguinea* rarely exceed 3 mm wide, and the leaf width of M. tenuifolia rarely measures less than 3 mm.

Maxillaria schistostele Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:303–304. 1923. TYPE: Costa Rica, near San Ramón, *Acosta s.n.* (photo of type: AMES).

Plant a somewhat spreading, ascending epiphyte; rhizomes 4-5 mm in diameter, the segments about 1.5 cm between pseudobulbs. Pseudobulbs ovoid or oblong, 1-1.3 cm long, subtended by nonfoliaceous sheaths, the apex 1-foliate. Leaves linear-ligulate, 6-9 cm long, 6-8 mm wide, the base somewhat narrowed, apex obtuse and emarginate. Inflorescence slender, borne at the pseudobulb base; scape 6-8 cm long; ovary with pedicel about 1.3 cm long, somewhat exceeded by the floral bract. Flowers rigid in dried specimens, glabrous except for the lip; color unknown. Sepals linear or linear lanceolate, 2.2 cm long; lateral sepals oblique, forming with the column foot an obtuse, shortly conic mentum. Petals linear, acuminate, 1.6 cm long. Lip minutely papillose, 1.25 cm long including the distinct claw (2.5 mm long) at the base; forming an abruptly lanceolate blade 1 cm long, 5 mm wide; callus at the base obovate, obtusely sulcate. Column arcuate, 6 mm long, the apex thickened, the anther bed with fimbriate margin; foot at the base 2 mm long.

Maxillaria schistostele is known only by a photograph of the type collection but is clearly related to the M. acuminata complex in South America,

a group characterized by the rhizomatous habit, usually 2-foliate pseudobulbs (1-foliate in this species), wiry scapes, and entire lips. Nothing is known of its ecology or phenology. The above description is translated and condensed from Schlechter's original description.

Maxillaria schlechteriana J. T. Atwood, Lindleyana 9:231. 1994. Basionym: Camaridium imbricatum Schltr., Beih. Bot. Centralbl. 36:415–416. 1918. TYPE: Costa Rica, La Palma, Wercklé (isotype: AMES). Ornithidium schlechterianum C. Schweinf., nom. illeg., Bot. Mus. Leafl. 4:94. 1937. Maxillaria wrightii (Schltr.) Ames & Correll var. imbricata (Schltr.) Ames & Correll, Bot. Mus. Leafl. 11:18. 1943. Not Maxillaria imbricata Barb. Rodr. Figure 14A.

Plant a straggly, erect to pendent, cane-forming epiphyte to about 50 cm tall; shoot slender, terminated by a pseudobulb, to 30 cm long; rhizome wiry, concealed by scales when young, apparently turning black with age. Roots white, to 1 mm in diameter. Pseudobulbs compressed, ovoid to suborbicular, 1-3 cm long, mostly concealed at the base by foliaceous sheathes, apically 1foliate. Leaves with petiole broadened below the articulation and about 4-1/3 the blade length; blade ellipticlanceolate, carinate beneath, 2.5-18 cm long, 8-40 mm wide, acute to obtuse. Inflorescence 1 per nonfoliaceous bract axil, forming on the developing shoot; scapes to about 2 cm long; ovary with pedicel 3.5-6 mm long, subtended by a somewhat cucullate floral bract 7-11 mm long. Flowers white or light lavender to rose; column often darker. Sepals similar, oblong, acute; dorsal 1.2-1.5 cm long, 4 mm wide; lateral sepals somewhat oblique, 1.25-1.5 cm long, 4-5 mm wide. Petals oblong, 1-1.4 cm long, about 3 mm wide, acute. Lip rigid with the column foot, lateral view somewhat sigmoid but base not saccate, 6-8 mm long in natural position; lateral lobes extending to 3/3 the lip; midlobe fleshy; callus tonguelike between the lateral lobes. Column 2.5–3 mm long without anther; anther about 1 mm long; pollinia 4, with somewhat square stipe. Capsule ellipsoid to globose, about 1 cm long.

Epiphytic and terrestrial in montane cloud forests at (1000)1400–2800 m. Flowering August to March. Costa Rica and Panama; doubtfully reported from Nicaragua as *M. wrightii* var. *imbricata*.

This species is most similar to *M. paleata* (Rchb. f.) Ames & Correll, with which it is often sympatric. However, that species has larger, darker, red-purple flowers with a lower column-to-lip-length ratio. Also, the profile of the lip is somewhat different. Among herbarium specimens, no intermediates suggesting hybrids have been seen.

Maxillaria scorpioidea Kraenzl., Svensk. Vet. Akad. Handl. 46:71. 1911. TYPE: Brazil, Matto Grosso. ?Maxillaria rhodosticta Kraenzl., Repert. Spec. Nov. Regni Veg. 24:223. 1928. TYPE: Mexico. Figure 8D.

Plant a straggly epiphyte, or if cespitose consisting of several ascending successively borne shoots to 2(3) cm apart. Roots white, to 1 mm in diameter. Pseudobulbs narrowly ovoid 2-5 cm long, 1-1.7 cm wide, compressed, conspicuously ribbed when dried, subtended by 1-2 leaf-bearing rhizome bracts, apically (1)2-3foliate. Leaf blades linear to very narrowly elliptic, 2-24 cm long, 6-15 mm wide. Inflorescence 1 per rhizome bract axil; scapes 1-2 cm long, concealed by 2 or more acute, somewhat inflated bracts; ovary with pedicel 1.6-2 cm long, subtended by a pair of glumaceous bracts, the uppermost 16-21 mm long. Flowers greenish, yellowish, or buff, lip with maroon spots on the margins, often tipped with maroon. Sepals similar; dorsal narrowly lance-elliptic, acute, apically and dorsally carinate, 18-25 mm long, to 5 mm wide; lateral sepals the same size, lanceolate, acute. Petals narrowly elliptic, falcate, 16-22 mm long, 2.5-4 mm wide. Lip arcuate, narrowly elliptic, 15-18 mm long, the apex thickened, oily; callus linear, oily to just below the middle. Column slender, somewhat arcuate, 12-14 mm long; foot 2 mm long; pollinia 4, with elongate stipe and saddle-shaped viscidium. Capsule somewhat down-curved, ellipsoid, 2-3 cm long including the beak.

Epiphytic in moist forests at 500–1800 m. Flowering mostly November to March. Mexico (southern Chiapas) to western El Salvador, Costa Rica and western Panama, and Brazil and Ecuador. In Central America this species is known only from the Pacific drainage.

The identification of the name is based on the original description with illustration showing consistent floral dimensions and color. The name M. rhodosticta probably applies to this species because the original description indicates nearly exact floral dimensions and the spotting on the lip margin. Maxillaria scorpioidea has for more than a century caused confusion with M. friedrichsthalii Rchb. f. and M. aciantha Rchb. f. because its floral size is intermediate between the other two. The close spacing of the shoots and spotting pattern on the lip margin are usually good features for field recognition. One should look at column length (excluding the foot), which is shorter in M. friedrichsthalii and longer in M. aciantha. Floral size and color are usually closer to those of M. friedrichsthalii than M. aciantha, but, as with the latter species, M. scorpioidea has a much longer bract subtending the flower. Except perhaps in western Panama, M. scorpioidea is sympatric only with M. friedrichsthalii in its more northern range, and it probably does not

occur much below 500 m. In dried specimens *M. scorpioidea* often has a golden, waxy appearance that is lacking in the other two species.

Maxillaria serrulata Ames & Correll, Bot. Mus. Leafl. 11:16. 1943. Camaridium amparoanum Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 56–57. 1923. TYPE: Costa Rica, San Jeronimo, Wercklé 122 (drawing of type: AMES). Ornithidium amparoanum (Schltr.) Pabst, Bradea 2:87, 1976. Not Maxillaria amparoana Schltr. Figure 17A.

Plant a somewhat straggly, cane-forming epiphyte, to about 50 cm high; stems upright or pendent, each terminated by a pseudobulb; rhizome conspicuous, 2-10 cm long. Roots less than 1 mm in diameter. Pseudobulbs ovoid, 1.5-2.5 cm long, protected at the base by 1-3 leaf-bearing, rugose sheaths; apex 1-foliate. Leaves articulate, without petiole; blades ligulate, obtuse to emarginate, abaxially keeled and mucronate, to 13 cm long, 2.2 cm wide. Inflorescences appearing at the base of mature pseudobulbs with the flush of the new growth; scapes to about 3 cm long, concealed by compressed, subulate bracts; ovary with pedicel to 1 cm long, much exceeded by the subtending, acute floral bract to 3 cm long. Flowers dark red with some green within. Sepals similar, obovate, 2.5 cm long, 1.5 cm wide, obtuse; dorsal somewhat concave; lateral sepals somewhat oblique at the base. Petals obovate, 1.8-2 cm long, 9-11 mm wide. Lip complex, hinged to the column foot, 3-lobate below the middle, about 1 cm long, 8-9 mm across the midlobe; lateral lobes rounded and erect around the column; midlobe suborbicular, with a dentate margin; callus of about 7 keels higher at the base and becoming lower apically. Column arcuate, 8 mm long excluding the anther; anther 1.5 mm in diameter; foot 3 mm long.

Probably epiphytic but poorly known ecologically; 1400–2000 m. Flowering July and August. Endemic to Costa Rica.

It is easily distinguished by the dark red flowers and serrulate lip but is poorly known despite the handsome flowers. It seems to be related to other species, including *M. sigmoidea*, but little is known of some aspects of the plant, e.g., whether the petioles of the foliaceous rhizome bracts are abruptly narrowed.

Maxillaria sigmoidea (C. Schweinf.) Ames & Correll, Bot. Mus. Leafl. 11:16. 1943. *Ornithidium sigmoideum* C. Schweinf., Bot. Mus. Leafl. 4: 121–122. 1937. TYPE: Costa Rica, Cerro Gallito, *Valerio* 72 (holotype: AMES). Figure 13D.

Plant somewhat straggly, epiphytic, or terrestrial, erect or pendent when large, to about 1 m long; stems elongate, often branched, each shoot to 30 cm long and terminated by a pseudobulb. Roots white, to 1 mm in

diameter. Pseudobulbs ovoid to suborbicular, 1-4 cm long and the uppermost strongly reduced, usually concealed by 1-3 foliaceous sheaths, apically 1-foliate. Leaves with petiole up to about 1/3 the blade length; blade oblong-elliptic, keeled abaxially, 6-27 cm long, 1.5-5.5 cm wide, much reduced in distal shoots; apex acute, acuminate, or somewhat attenuate. Inflorescences a single-flowered scape borne singly within nonfoliaceous, scarious, acute sheaths of the developing shoot; scape to 5 cm long; ovary with pedicel 1-1.5 cm long subtended by a somewhat membranaceous, cucullate, acute bract 1.5-2.1 cm long. Flowers light pink to lavender with white lip striped with lavender; column often yellowish apically. **Sepals** similar, lanceolate-elliptic, the lateral somewhat oblique, 1.8-2.4 cm long, 6-8 mm wide, acute or shortly acuminate. Petals elliptic-oblanceolate, 2-2.2 cm long, 5-5.5 mm wide, acute. Lip complex for the genus, rigid with the column foot, forming a deeply saccate base, the apical 34 sharply reflexed and appearing sigmoid laterally, 9-13 mm long, to 6 mm wide with the lateral lobes spread; lateral lobes falcate, diverging near the upper third, embracing the column apex; midlobe ovate, thickened apically; callus fleshy, continuous with the lateral lobes, rounded to somewhat 3-dentate in front, exceeding the sinuses between lobes. Column cylindric, somewhat arcuate, broadened above, 8-12 mm long; with short foot to about 2 mm long at the base; anther shortly beaked; with protruding viscidium; pollinia 4. Capsule 1.5 cm long.

A plant of windy cloud forests at 1400-2100 m. Flowering October to December and February to April. Costa Rica and Panama.

The unmistakable sigmoid appearance of the lip is unique among Costa Rican *Maxillaria*; otherwise the flowers appear similar to those of a large *M. schlechteriana* J. T. Atwood or a small *M. vaginalis* Rchb. f.

Maxillaria strumata (Endres & Rchb. f.) Ames & Correll, Bot. Mus. Leafl. 11:17. 1943. Ornithidium strumatum Endres & Rchb. f., Gard. Chron. 2:772. 1874. TYPE: Costa Rica, Endres 281 (holotype: W; isotype: AMES). Sepalosaccus strumatum (Endr. & Rchb. f.) Garay, Caldasia 8:525. 1962. Sepalosaccus humilis Schltr. Repert. Spec. Nov. Regni Veg. Beih. 19:244–246. 1923. TYPE: Costa Rica, San Pedro de San Ramón, Brenes 130 (lectotype: AMES). Figure 19B.

Plant a densely cespitose epiphyte to about 6 cm tall. Roots filiform, < 0.5 mm in diameter. Pseudobulbs approximate, narrowly ovoid to cylindric, to about 5 cm tall, 6 mm wide, subtended when young by 1–2 foliaceous bracts, the apex 1-foliate. Leaf blades thin, narrowly elliptic to oblong, obtuse, to 5.5 cm long, 8 mm wide, the apical leaf shortly petiolate. Inflorescence 1 per nonfoliaceous bract axil of the rhizome, to about 1.5 cm long; ovary with pedicel 4.5–6 mm long, exceeded by the subtending acuminate floral bract. Flowers white, lip apex yellow, anther dark purple. Sepals dissimilar;

dorsal oblong, concave at the base, recurved at the obtuse apex, 4–5 mm long, about 1.2 mm wide; lateral sepals about ¾ connate, each oblong, 7–8 mm long. **Petals** oblong, 4–4.5 mm long, 1–1.2 mm wide, obtuse. **Lip** subsaccate and continuous with the column foot, somewhat 3-lobate on the apical ½, about 4.5–5 mm long when spread; lateral lobes broadly rounded and embracing the column, connected at the apex by a transverse tonguelike callus; midlobe ovate, somewhat constricted below the base, with recurved margins, obtuse. **Column** stout, about 2 mm long excluding the anther; foot about 2.5 mm long, anther about 1 mm in diameter.

Epiphytic in wet forests; the type locality is 1100 m. Flowering at least September; in cultivation at Selby Gardens, it flowers at various times of the year.

Maxillaria strumata is related to the M. neglecta group but has a much more cespitose plant habit. It is little collected, probably because of its small size, but has been collected by R. L. Dressler at "low" elevation near San Joaquín de Dota.

Maxillaria suaveolens Barringer, Brittonia 37(1): 44–46. 1985. TYPE: Costa Rica, Puntarenas, Esquinas forest, area between the Rio Esquinas and Palmar, *P. H. Allen 5323* (holotype: F; Isotypes: MO, NY, SEL). Figure 14C.

Plant known only from the type, epiphytic, somewhat repent or apparently pendulous; shoots developing 4-8 cm apart. Roots to 1 mm in diameter. Pseudobulbs apically 1-foliate, somewhat compressed, ovoid, 3.5-5 cm long, and perhaps 2 cm wide in live material, mostly hidden when young by 2-4 subtending leaves. Leaves subcoriaceous, oblong to narrowly obovate, shortly petiolate; blade 10-17 cm long and 3-5 cm wide, retuse. Inflorescences 1-few per rhizome bract axil of immature shoots, each 5-7 cm long, covered with about 5 inflated, acute bracts; ovary with pedicel enclosed in the uppermost bract before pollination, 1.8-2.0 cm long. Flowers fragrant, white with butter yellow lip. Sepals elliptic-obovate, 4–5 cm long, 1.8(–2.3) cm wide, acute. Petals elliptic-obovate, 3.7-4 cm long, 1.5-2 cm wide, acute to obtuse. Lip hinged to the column foot, about 1.5-2 cm long, 3-lobate above the middle; callus on the lower half ligulate; midlobe about 6 mm long, ovate. Column arcuate, 1 cm long; foot about 5 mm long.

"Epiphytic in tops of large trees" at less than 50 m. Flowering September. Costa Rica; known only from the type collection.

The large, fragrant (Allen compared its fragrance to that of narcissus), and attractive flower, which should be conspicuous to collectors, suggest that this is a rare species, but the plant is probably a crown epiphyte where orchids are unseen except in felled forests or branch falls. Also, the plant may rarely be in flower and thus over-

looked by collectors if the flowers last only 3 days, as indicated on the herbarium label. More field collections, including liquid-preserved flowers and observations on growth habit, are badly needed. Floral dimensions are taken from one rehydrated flower and from the original description.

Maxillaria tenuifolia Lindl., Edwards's Bot. Reg. 23: sub. t. 1986. 1837. TYPE: Mexico, Veracruz, *Hartweg. ?Maxillaria gracilifolia* Kraenzl., Mitt. Inst. Allg. Bot. Hamburg 6:420. 1927. Figure 10D.

Plant a densely clumping epiphyte to about 75 cm across, comprised of numerous decumbent to pendent shoots 1-8 cm apart. Roots white, to 1.5 mm in diameter. Pseudobulbs cylindric to fusiform, somewhat compressed, 2-5 cm long, 1-2 cm wide, subtended by bladeless rhizome bracts, or if with blades these falling at maturity, the apex 1-foliate. Leaves linear, 15-50 cm long, 3-8 mm wide. Inflorescence 1 per rhizome bract of mature shoots, 1-2 cm long, covered by acute sheaths and subtending rhizome bract; ovary with pedicel 3-4 cm long, much longer than the subtending bract. Flowers variously blood red, purple-red, or yellowish spotted with red, the lip yellow or white spotted with red, fragrant, similar to that of coconut (crayons?). Sepals lanceolate-ovate, 2-3 cm long, 6-9 mm wide. Petals elliptic-lanceolate, somewhat falcate, apical margins erose, 1.9-2.7 cm long, 5-8 mm wide. Lip simple, elliptic, constricted on the apical ¼, forming a reflexed apex; callus on the lower 1/3 or just above, oblong, thickened and rounded in front, thickened on the sides. Column arcuate, 1-1.3 cm long; foot 2 mm long. Capsule ellipsoid, 3-4 cm long.

Large clumping to distinctly rhizomatous epiphyte of larger trunks and branches in (semi-)evergreen forests at 100–1200 m. Flowering March to May. Mexico (Campeche, Chiapas, San Luis Potosi, Yucatan, and Veracruz) to Costa Rica.

Maxillaria tenuifolia is replaced geographically in central Costa Rica by M. sanguinea, which flowers in January and February, lacks the strong fragrance of M. tenuifolia, and usually has narrower leaves.

Maxillaria tigrina C. Schweinf., Amer. Orch. Soc. Bull. 37:409–410. 1968. TYPE: Costa Rica, Province of Heredia, *R. T. Northen s.n.* (holotype: AMES). *Chrysocycnis tigrinum* (C. Schweinf.) Atwood, Icon. Pl. Trop. 14: t. 1306. 1989. Figure 11B.

Plant a straggly, partially pendent epiphyte; shoots 4–7 cm apart. Roots small, white, to 0.5 mm in diameter. Pseudobulbs cylindric, subtended by non-blade-bearing sheaths, apically 1-foliate, 2–3 cm long. Leaves coria-

ceous, elliptic, the petiole 1-2.5 cm long; blade 5-10 cm long, 1–2 cm wide, sulcate along the midvein and keeled beneath. Inflorescence 1 per rhizome bract axil, 1.5-2 cm long, borne on the rhizome; ovary with pedicel 1.5 cm long, slightly shorter than the subtending, inflated, acute floral bract. Flowers leathery, translucent brownish, lined with purple. Sepals similar; dorsal lance-elliptic, concave, 2.6 cm long, 8 mm wide, acute; lateral sepals lance-ovate, reflexed near the base, cuspidate apically, 2.4 cm long, 1 cm wide, acute. Petals ellipticovate, 2.4 cm long, 9 mm wide, acute. Lip 3-lobate, glabrous, 1.8 cm long; lateral lobes acute, spreading; midlobe triangular, twice as long as the base; callus transverse, ridgelike, terminating between the lateral lobes. Column arcuate, to 8 mm long; pollinia 4, with squarrose stipe and saddle-shaped viscidium.

Epiphytic in montane cloud forests at 1900–2000 m. Flowering July. Costa Rica and Panama.

The arcuate column, unique 3-lobate lip, and plant habit, as well as general floral shape, are features more consistent with South American *Chrysocycnis*. The lip is glabrous, the lateral lobes more acute, and the column shorter than in the South American species, but the plant habit as well as major floral features are those of *Chrysocycnis*. Cladistic analyses based on DNA studies are needed to resolve this question.

Maxillaria tonduzii (Schltr.) Ames & Correll, Bot. Mus. Leafl. 11:17. 1943. Camaridium costaricense Schltr., Repert. Spec. Nov. Regni Veg. 3:250. 1907. TYPE: Costa Rica, La Palma, Tonduz 12429 (isotypes: US 577589, 815052, 815053; drawing of type: AMES). Camaridium tonduzii Schltr., Repert. Spec. Nov. Regni Veg. 8:571. 1910. TYPE: Costa Rica, Tonduz 12429 (same collection as for Camaridium costaricense Schltr.). Maxillaria heidelbergensis Senghas, nom. illeg. Orchidaceen (ed. 3) 29:1751. 1994. Figure 4C.

Plant an erect or decumbent, apparently monopodial epiphyte to about 2 m tall lacking pseudobulbs; stems occasionally branched, sometimes fasciculately so, with each branch arising nearly parallel with the main stem, concealed by the somewhat rugose leaf sheaths. Roots white, to about 1 mm in diameter. Leaf blades above the articulation ligulate, 2-13 cm long, 5-15 mm wide; apex rounded to unequally 2-lobate. Inflorescence 1–3 per leaf axil, shorter than the subtending leaf; scapes to about 5 cm long; ovary with pedicel (7)10-11 mm long, subtended by a hyaline, acute floral bract 1.3-1.7 cm long. Flowers brick red or green stained with reddish brown; lip white with purple spots. Sepals somewhat canaliculate, lanceolate, 1.7-2.3(3.7?) cm long, (3.5)4-5 mm wide, acute; lateral sepals somewhat oblique. Petals linear-lanceolate, 1.4-1.9 cm long, 2.5-3.5 mm wide, acute. Lip hinged to the column foot, arcuate in natural position, 3-lobate above the middle, 7-9.5 mm long, 6.5–9 mm wide when spread; lateral lobes somewhat clasping the column, the apex forming nearly a right angle; midlobe somewhat flared, rounded in front; callus ligulate from near the base to just above the middle, elevated in front, with several sharp teeth at the base that in some specimens seem to form more or less into 3 rows. **Column** stout, somewhat arcuate, 5–6 mm long excluding the anther; foot 3 mm long; anther 1 mm long, verrucose.

Epiphytic and terrestrial in montane rain forests at 1300–1650 m. Flowering season incompletely known; at least August, October, February, and March. Apparently endemic to Costa Rica, although similar plants have been collected in adjacent Panama with more attenuate sepals and petals.

Maxillaria tonduzii is unique for its tall canes and brick red flowers with purple-spotted, white lip.

Maxillaria trilobata Ames & C. Schweinf., Bot. Mus. Leafl. Harvard Univ. 11:17. 1943. *Camaridium brenesii* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:237. 1923. TYPE: Costa Rica, San Ramón, *Brenes* 233 (photo of type: AMES). Figure 3D.

Plant a large epiphyte with apparently monopodial canes (adults) to 1 m long. Roots white, to about 1 mm in diameter. Pseudobulbs lacking in adults but possibly present in unknown juveniles. Leaves supported on elongate, tapering sheaths to about 15 cm long including the petiole above the oblique articulation; blade subcoriaceous, 10-25 cm long, 4-6 cm wide; apex rounded to acute. Inflorescences several per leaf axil; scapes about 8 cm long, covered by membranaceous, acute bracts; ovary with pedicel 7-10 mm long, exceeded by the subtending inflated bract. Flowers small, white with yellow and red on lip. Sepals oblong-ovate, 1.2–1.8 cm long, 5-7 mm wide. Petals elliptic-oblanceolate, 1-1.5 cm long, to 6 mm wide, acute. Lip articulated to the column foot, deeply 3-lobate on the apical 1/3, 9-10 mm long, 9–10 mm wide; callus ligulate on the lower ½. Column cylindric, 3-5 mm long, extended at the base into a foot 1 mm long. Capsule obovoid, about 2-2.5 cm long.

A large epiphyte in cloud forests at 1000–1700 m. Flowering November to May. Costa Rica and Panama.

Maxillaria trilobata is vegetatively similar to M. inaudita Rchb. f. in the long, petiolate leaves but has much smaller flowers with a deeply 3-lobate lip. The drawing in the Ames herbarium of the type showing the long, tapering petioles and small flowers with a deeply 3-lobate lip leaves little doubt as to the identity.

Maxillaria tubercularis J. T. Atwood, Lindleyana 9:229–231. 1994. TYPE: Panama, Chiriquí, Fortuna Dam region, along trail to Cerro Hornito, *McPherson 13567* (holotype: MO). Figure 8A.

Plant a conspicuously rhizomatous epiphyte to about 50 cm tall; stems erect when young, pendent when large, rooted at the base, concealed by tuberculate, nonfoliaceous bracts. Roots to about 1 mm in diameter. Pseudobulbs ovoid, compressed, 2.5-5 cm long, 1-2.25 cm wide, 3-10 cm apart, concealed when young by 2-3 tuberculate, foliaceous sheaths, the apex 1-foliate. Leaves with petiole 1/6-1/3 the blade length, the lateral width 3-4 mm; blade coriaceous, narrowly elliptic, 6-15 cm long, 1-3 cm wide; apex acute. Inflorescences apparently restricted to nonfoliaceous bract axils of the mature or immature rhizome; scapes less than 2 cm long; ovary with pedicel 1.3–1.6 cm long, subtended by a subequal, inflated, acuminate floral bract. Flowers well expanded, yellow with many red to maroon spots; lip red or maroon. Sepals dissimilar, ovate, acute; dorsal somewhat concave, 1.9-2.2 cm long, 8.5-14 mm wide; lateral sepals attached to the column foot, 1.8-2.2 cm long, 1.2 cm wide. Petals elliptic-ovate, somewhat oblique, 1.5-1.7 cm long, 6-7 mm wide, acute to obtuse. Lip not firmly attached to the column foot, ovate in general outline when spread, 1.2-1.3 cm long, 9-10 mm wide, 3lobate at about the middle; lateral lobes variable, acute to rounded, somewhat exceeded in front by the fleshy, subquadrate, emarginate callus; midlobe ovate, rounded, with crenulate margin. Column arcuate, about 9 mm long excluding foot and anther, foot 5-6 mm long. Capsule ellipsoid, 3-alate.

Epiphytic in evergreen (often oak) forests at 1300–2700 m. Flowering August, December, and January. Endemic to southern Costa Rica and Chiriquí, Panama.

Maxillaria tubercularis most closely resembles M. elatior, found to the north, but is generally smaller in all vegetative parts and occurs at much higher elevations.

Maxillaria umbratilis L. O. Williams, Ann. Missouri Bot. Gard. 28:425. 1941. Camaridium nutantiflorum Schltr., Beih. Bot. Centralbl. 36, Abt. 2:417. 1918. TYPE: Costa Rica, La Palma, C. Wercklé (isotype: CR). Camaridium vinosum Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 240. 1923. TYPE: Costa Rica, San Ramón, A. M. Brenes 234 (lectotype: CR; isolectotypes: AMES, NY). Maxillaria vinosa (Schltr.) Senghas, Orchidaceen (ed. 3) 29:1751. 1994. Not Maxillaria nutantiflora Schltr. Not Camaridium vinosum Rolfe. Figure 15A.

Plant a subshrub to about 1 m tall, of 1 or more canelike shoots, each 10-30 cm long, terminating in a

pseudobulb and forming at the base of the previously developed pseudobulb. Roots white, to 2 mm in diameter. **Pseudobulbs** ovoid, biconvex, 3.5–5 cm long, 1(2)foliate, with 2-5 blade-forming rhizome bracts at the base. Leaves coriaceous, petiolate including the rhizome bracts (early deciduous), the blade narrowly elliptic-lanceolate, to about 20 cm long, 2 cm wide, the apex obtuse and often retuse. Inflorescence 1 per axil of the halflyre-shaped rhizome bract of the developing shoot; scapes ≥4 cm long, covered by acute sheaths; ovary with pedicel 10-13 mm long, subtended and exceeded by a cucullate floral bract 15-21 mm long. Flowers variously colored, yellowish green, greenish white to orange, suffused with red or entirely red, the lip often with red. Sepals similar, lanceolate, concave, 19-21 mm long, 4.5-5 mm wide, acute. Petals elliptic, attenuate toward both base and apex, 16-20 mm long, 5-6 mm wide. Lip hinged to the column foot, deeply 3-lobate, 10 mm long, 10 mm wide; lateral lobes spreading, falcate; midlobe triangular, acute, 5-6 mm long, with a fleshy V-shaped callus on the lower 1/4. Column stout, arcuate, 4-5 mm long; foot at the base 2.5-3 mm long. Capsule ellipsoid, about 2.5 cm long.

Epiphyte of wet forests or terrestrial on mossy embankments, especially road cuts at 1000–2800 m. Flowering January to April, July to October, and perhaps throughout the year. Costa Rica and Panama.

Maxillaria umbratilis is unique among species that produce half-lyre-shaped rhizome bracts in the flush of new growth by the smaller, rather dull-colored flowers with narrow floral segments. The basis for the understanding of Camaridium nutantiflorum is the original description and the floral diagnosis by Schlechter (Repert. Spec. Nov. Regni Veg. Beih. 59: t. 68 No. 271. 1931), which shows the callus rather poorly rehydrated. Actually, the callus is more V-shaped in front than shown by his drawing, but when pressed the tips of the V tend to point forward. A rehydrated flower from *Brenes 234* shows the same type of callus. Schlechter recognized C. vinosum on the basis of the smaller size and the odd and probably abnormal inflexed lip apex, but there seems to be a continuum between the types. The dark flower color indicated by Brenes is probably based on either aged flowers, a color form, or perhaps plants in an unusually exposed location.

Maxillaria uncata Lindl., Edwards's Bot. Reg. 23: sub t. 1986. 1837. TYPE: Guiana, Loddiges s.n. (holotype: κ). Camaridium uncatum (Lindl.) Hoehne, Arq. Bot. Est. Sao Paulo 6: 127. 1952. Maxillaria macleei Bateman ex Lindl., Edwards's Bot. Reg. 26: misc. 70. 1840. TYPE: Guatemala. Maxillaria nana J. D. Hook., Ic. Pl. t. 315. 1841. TYPE: Guiana, C.

S. Parker, Maxillaria squamata Barb. Rodr., Gen. & Sp. Orch. Nov. 1:118. 1877. TYPE: Brazil (illustration in Flora Brasiliensis 3(6): t. 24). Ornithidium squamatum (Barb. Rodr.) Barb. Rodr., Gen. & Sp. Orch. Nov. 2:209. 1882. Camaridium squamatum (Barb. Rodr.) Hoehne, Arq. Bot. Est. Sao Paulo 2:72. 1947. Maxillaria stenostele Schltr., Beih. Bot. Centralbl. 36, Abt. 2:414. 1918. TYPE: Costa Rica, Rio Sucio, F. C. Lehmann 1236 (holotype: B, destroyed). Maxillaria striatella Kraenzl., Repert. Spec. Nov. Regni Veg. 24:359. 1928. TYPE: Guatemala. Figure 10C.

Plant variable in habit, usually repent with shoots 1 or more cm apart or cespitose with shoots approximate, or appearing cespitose with many ascending shoots each spaced 1 or more cm apart. Roots to 1 mm in diameter. Pseudobulbs cylindric, apically 1-foliate, about 1 cm long, concealed by scaly rhizome bracts. Leaves variable, even in the same shoot, always fleshy, flat to terete, narrowly elliptic to oblong or linear, acute, 1.5-6 (or more) cm long, 2-6 mm wide. Inflorescence 1 per rhizome bract axil; scapes to 1 cm long, concealed by bracts; ovary with pedicel 14 mm long, much exceeding the subtending floral bract. Flowers light lavender to waxy white, lined with purple. Sepals dissimilar; dorsal ovate, concave, 9 mm long, 4 mm wide, acute; lateral sepals triangular, formed around the long column foot, 1.5 cm long from the tip of the foot to the apex, 5 mm wide, acute. Petals obliquely ovate, 8-9 mm long, 4 mm wide. Lip ligulate, canaliculate on the lower 34, constricted on the apical ¼, with a ligulate callus thickened apically and appearing parabolic in front, reaching beyond the middle. Column arcuate, 1.4 cm long including the 8-mm-long foot, broadened and deepened above to accommodate the large pollinarium with stipe 2.5-3 mm long appearing hooklike when viewed laterally. Capsule ellipsoid, about 1 cm long.

Epiphytic on the larger branches of trees in wet forests, mostly at low elevations but to 1500 m. Flowering throughout the year. Locally common in Central America, but in Mexico known only from Chiapas; probably widespread in South America.

The fleshy, dark green leaves and waxy, purplenerved flowers with a very long column foot and long stipe are good features for recognition. Flowers of Central American forms are darker and have a longer callus than do most forms from South America, and possibly there are two or more species here accepted as one. Some plants from northern South America have creamy white flowers. The type of *M. uncata* shows the shorter callus of South American forms.

Maxillaria vaginalis Rchb. f., Beitr. Orchid.-K.C.Amer. 77. 1866. TYPE: Costa Rica, Desengaño, *Wendland 1247* (holotype: w). *Camaridium wercklei* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:58–59. 1923. TYPE: Costa Rica, San Cristobal, *Wercklé 5* (Drawing of type: AMES). Figure 13F.

Plant a somewhat straggly, erect to decumbent, caneforming epiphyte or terrestrial to about 1 m long; stems anchored at the base, concealed by bracts, formed from successively borne shoots each terminated by a pseudobulb and diminishing in size from the base. Roots to 1 mm in diameter. Pseudobulbs ovoid, compressed, 1-3.5 cm long, concealed by imbricate bracts and sheaths of the subtending 1-3 leaves; apex 1-foliate. Leaves at base of pseudobulb with conspicuous sheaths constricted at the articulation, apical leaf conspicuously petiolate; blades similar, keeled below, narrowly elliptic, 7-30 cm long, 1.5-6 cm wide, acute. Inflorescence 1 per nonfoliaceous rhizome bract axil of developing shoots, not within the axils of developing leaves; scapes to about 4 cm long; ovary with pedicel 1-1.2 cm long, exceeded by the subtending acute floral bract to about 2.5 cm long. Flowers delicate in texture, white to pink, lip white, column anther yellowish. Sepals similar, oblong, acute, 3-4 cm long, about 1 cm wide; dorsal somewhat concave; lateral sepals oblique and recurved at about the middle. Petals falcate-oblanceolate, 3.5 cm long, to 1 cm wide, acute. Lip firmly attached to the column foot, canaliculate from the base, to about 2.4 cm long, 7 mm wide in natural position, apical ½ distinctly 3-lobate; lateral lobes somewhat spreading, rounded; midlobe ovate, obtuse; callus of 5 fleshy ridges within at the base and with a single fleshy, ligulate callus thickened apically and extending from below the middle to beyond the sinuses between lateral lobes. Column slender, arcuate, 1.4-1.7 cm long excluding the foot and anther; foot about 5 mm long. Capsule broadly ellipsoid, about 2 cm long with persistent column.

Epiphytic and terrestrial in wet montane forests at 1500–2600 m. Available data on collections suggest this may prefer habitats with high precipitation but little wind. Flowering July to October and February. Costa Rica to Panama.

Maxillaria vaginalis is one of the larger-flowered species of the M. sigmoidea complex. It is easily recognized by the rather large white to pink flowers on plants with pseudobulbs on the canes and a straight, not sigmoid, lip.

Maxillaria valenzuelana (A. Rich.) Nash, Bull. Torrey Bot. Club 34:121. 1907. Pleurothallis valenzuelana A. Rich., Sagra, Hist. Fis. Cuba 11:234. 1850. TYPE: Cuba, Valenzuela, Wright 3314 (holotype: P?). Marsupiaria valenzuelana (A. Rich.) Garay, Arq. Jard. Bot. Rio de Janeiro 12:183. 1952. Dicrypta iridifolia Bateman ex Rchb. f., Bonplandia 2:16. 1854. TYPE: Cuba, Poeppig (holotype: w). Maxillaria iridifolia

(Bateman ex Rchb. f.) Rchb. f., Bonplandia 2: 16. 1854. *Dicrypta irisphyta* Barb. Rodr., Gen. et Sp. Orch. Nov. 1:126. 1877. TYPE: Brazil, Minas Gerais (Martius, C. F. P. von, et al. 1896. Flora brasiliensis 3(6): t. 17, fig. 2). *Marsupiaria iridifolia* Hoehne, Arq. Bot. Est. São Paulo n.s. 2, pt. 4:71. 1947. Figure 18A.

Plant a pendent, psygmoid, glaucous, essentially monopodial epiphyte with very abbreviated nonswollen stems but lacking pseudobulbs. Roots grayish, to 2 mm in diameter. Mature leaves 5-10, equitant, remaining unexpanded, linear to lanceolate in profile, somewhat falcate, acute, 8-60 cm long, 1.4-2.7 cm wide measured from margin to midvein, articulation oblique. Inflorescence a fascicle of successively borne, single-flowered scapes; each scape to about 2 cm long, hidden by the subtending rhizome bract and covered by acute scape bracts; ovary with pedicel 2-2.5 cm long, subtended by a rudimentary, short, obtuse floral bract. Flowers presented downward with the pendent shoot, greenish yellow, the lip deeper yellow with spots of red or purple. Sepals narrowly elliptic to broadly lanceolate, 12-18 mm long, 3-5 mm wide, acute. Petals elliptic, 10-16 mm long, about 3 mm wide, acuminate. Lip fleshy, rhombic to obovate and slightly 3-lobate above the middle, 10-15 mm long, 5-7 mm wide; midlobe broadly acute, fleshy, 4-5 mm long. Column about 5 mm long, forming a short foot at the base. Capsule ellipsoid, 2.5 cm long.

A pendent epiphyte of trunks and larger branches in premontane wet forests at 1000–1500 m. Flowering throughout the year. Eastern Cuba (type), Nicaragua, Costa Rica and adjacent western Panama, Colombia, Venezuela, and Brazil.

Maxillaria valenzuelana varies in plant and flower size over the range. Specimens seen from eastern Cuba have leaves that are broad at the base and somewhat abruptly tapering as in Costa Rican material. All material from Nicaragua has noticeably narrower leaves. Floral size of specimens from Costa Rica and Panama is about 50% larger than in those from Nicaragua and Honduras, a feature consistent with the larger leaves.

Maxillaria valerioi Ames & C. Schweinf., Sched. Orch. 10:96–97. 1930. TYPE: Costa Rica, Province of Cartago, vicinity of Pejivalle, *Standley & Valerio 46940* (holotype: AMES; isotype: US). Figure 2D.

Plant a shrubby epiphyte on large branches; rhizomes forming mostly upright canes sometimes with a few branches, entirely concealed by sheaths. Roots fibrous, white, mostly forming at the base of the plant and infrequently on the canes, rarely to 1 mm in di-

ameter. Pseudobulbs absent. Leaves densely distichous, the sheath orangish in dried material, with hyaline margins; blade coriaceous, short leaves elliptic, long leaves lanceolate, 1-10 cm long, 5-10 mm wide, the base clasping, the apex unequally 2-lobate. Inflorescence 1 per leaf axil, mostly concealed by subulate bracts; scapes 1-3 cm long; ovary and pedicel 3-5 mm long, exceeded by the subtending floral bract. Flowers campanulate, white aging yellowish. Sepals 8.5-11 mm long, 2-2.5 mm wide; dorsal elliptic-lanceolate, acute; lateral falcate-lanceolate and acute to rounded. Petals elliptic, 7.5-9 mm long, 2-3 mm wide, obtuse. Lip pandurate in outline, with lateral lobes on the basal ½, obtuse to acute in front; midlobe rhombic to broadly oblanceolate; callus fleshy, ligulate on the lower 1/2. Column and foot 5-6 mm long excluding the anther; foot 1–1.5 mm long.

Epiphytic and locally common, sometimes terrestrial in premontane rain forests at 550–1300 m. Flowering January to July. Costa Rica and western Panama.

Vegetatively, *M. valerioi* is extremely variable in leaf size, shape, and density. It resembles members of the *M. dendrobioides* complex, but the white flowers and long, narrow, pandurate lip distinguish it.

Maxillaria variabilis Bateman ex Lindl., Edwards's Bot. Reg. 23: sub. t. 1986. 1837. TYPE: Mexico. Maxillaria curtipes Hook. f., Ic. Pl. 4: t. 384. 1841. TYPE: Guatemala J. Parkinson (holotype: κ). ?Maxillaria chiriquensis Schltr. Repert. Spec. Nov. Regni Veg. Beih. 17:68. 1922. TYPE: Panama, Chiriquí, ca. 4000 ft, Powell 125 (isotypes: AMES, US; drawing of type: AMES). Figure 11C.

Plant a somewhat straggly epiphyte to about 25 cm high. Stems elongate; pseudobulbs approximate to about 4 cm apart. Roots to about 1 mm in diameter. Pseudobulbs fusiform to cylindric, often glaucous, subtended by nonfoliaceous sheaths, apically 1-foliate, 1.5-4 cm long, to 1.25 cm wide. Leaves thin, usually shortly petiolate, the blade narrowly elliptic to lanceolate, 5-14 cm long, 6-20 mm wide, the apex obtuse to unequally 2-lobate. Inflorescence formed in the flush of new growth, to about 2 cm long; ovary with pedicel 1.3-2 cm long. Flowers orange to yellow with red stain, rarely dark red (Mexico), the lip yellow with dark, shiny red center. Sepals similar, lanceolate to elliptic, 1-1.5 cm long, about 5 mm wide, acute to obtuse; dorsal concave and more elliptic, the lateral more lanceolate to falcate. Petals oblanceolate, 1-1.4 cm long, 4-5 mm wide; apex acute and strongly recurved. Lip simple to lightly 3-lobate, more or less straight with the sides somewhat embracing the column, elliptic-ovate, 1-1.3 cm long, 5-6.5 mm wide; apex truncate to rounded or retuse; callus a fleshy and shiny ligule on the lower ½. Column arcuate, 6-9 mm long excluding the anther; foot 1.5-2 mm long.

Plants of semideciduous forests at 600-1800 m. Flowering November to April and August. Mexico to Panama; possibly to Peru.

Maxillaria variabilis is most closely related to M. caespitifica Rchb. f. and M. costaricensis. Maxillaria caespitifica is a smaller plant with smaller, greener flowers, while M. costaricensis has green to cream red-stained flowers and occurs in wetter habitats. Populations north of the Central Valley have closer pseudobulbs than do those from southern Costa Rica. Maxillaria chiriquensis, here interpreted cautiously as a synonym, has yellow flowers, but the plant appears more slender, as in M. costaricensis. Other populations in southern Costa Rica have much stouter shoots with broader leaves than plants to the north. Various authors, including this one, have misinterpreted M. curtipes as an earlier synonym of M. houtteana Rchb. f., a species that doubtfully occurs in Costa Rica.

Maxillaria vittariifolia L. O. Williams, Ceiba 4: 38. 1953. TYPE: Costa Rica, Puntarenas, El General Valley C. H. Lankester 1581 (holotype: US; isotypes: AMES, SEL). Maxillaria linearis L. O. Williams, name. Not M. linearis C. Schweinf. Figure 25B.

Plant densely cespitose, very small, to 7 cm tall. Roots white, to 0.5 mm in diameter. Pseudobulbs orbicular to ovoid, 6-10 mm tall, 5-8 mm wide, subtended by 1-2 leaf-bearing rhizome bracts, apex 1-foliate. Leaves linear, 20-55 mm long, 1.5-2 mm wide, tapering toward the base. Inflorescence 1 per rhizome bract axil, slender, erect, equaling or exceeding the leaves, to 6 cm long, with 2-3 remote and inconspicuous bracts plus 1 subtending the flower; ovary with pedicel shorter than the subtending bract, about 2 mm long. Flowers white, the lip with bright orange apex. Sepals elliptic-ovate, 5 mm long, 1.6-2 mm wide, obtuse. Petals elliptic-oblong, 4.5 mm long, 1.5 mm wide, obtuse. Lip broadly obovate when spread, 3.5 mm long, 4 mm wide; apex divided into 3 equal lobes; midlobe reflexed and side lobes embracing the column, the central part with a pair of calli. Column stout, to 2.5 mm long; anther minutely papillose. Capsule globose.

Poorly known ecologically; epiphytic in premontane and lower montane primary forests at 900 m. Flowering probably throughout the year. Costa Rica, but to be expected in adjacent Panama.

This species is one of the smallest-flowered species of *Maxillaria* in Costa Rica with odd filiform peduncles and might better be classified in its own genus.

Maxillaria wercklei (Schltr.) L. O. Williams, Ann. Missouri Bot. Gard. 27:284. 1940. Ornithidium wercklei Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:60. 1923. TYPE: Costa Rica, San Pedro de San Ramón, Wercklé 61 (not found), Brenes 112 (neotype selected here: AMES 28776). Figure 13A.

Plant a somewhat straggly epiphyte to 15 cm tall; rhizome erect or decumbent, rooted mostly at the base. Roots to 0.5 mm in diameter. Pseudobulbs about 4 cm apart, cylindric to somewhat tapered, 1-1.5 cm long, about 5 mm wide at the base; subtended when young by 1–2 foliate sheaths; apex 1-foliate. Leaves coriaceous to fleshy, sessile, elliptic, 7-25 mm long, 5-10 mm wide, with unequally 2-lobate apex. Inflorescence 1 per rhizome bract axil of the developing shoot; scape less than 1 cm long; ovary with pedicel 3.5-4.5 mm long, exceeded by the subtending floral bract. Flowers translucent tan with red veins or entirely red. Sepals similar. elliptic-lanceolate, 6.5–9 mm long, 2–3 mm wide, acute; laterals inserted on the column foot. Petals elliptic-lanceolate, about 6-8 mm long, 2-3 mm wide, acute. Lip hinged to the column foot, ovate in general outline, 4.5– 5 mm long, about 3 mm wide when spread, 3-lobate at the base; lateral lobes short, not exceeding ¼ the lip; midlobe suborbicular, obtuse, the side margins much recurved; callus tonguelike exceeding and connecting the lateral lobes. Column stout, 1.5-2 mm long excluding the anther; foot about 1 mm long; anther about 1 mm in diameter.

Maxillaria wercklei is a premontane rain forest species at (300)500–1350 m. Flowering November to January and August. Apparently endemic to Costa Rica, but to be expected in adjacent Panama. Plants identified as M. wercklei from Panama appear to be M. lankesteri Ames.

The understanding of *M. wercklei* is based on the Brenes collection cited by Schlechter (Repert. Spec. Nov. Regni Veg. Beih. 19:244. 1923). Neither the holotype nor any isotypes of *M. wercklei* based on *Wercklé* 61 have been found. *Maxillaria lankesteri* is usually considered as a later synonym, but that species is easily distinguished by the much larger flowers.

Excluded Taxa

Maxillaria cobanensis Schltr., Repert. Spec. Nov. Regni Veg. 10:295. 1912. This was reported by L. O. Williams (1956) as occurring in Costa Rica, but specimens have been seen only from Mexico, possibly to Nicaragua. Despite the lack of specimens, R. L. Dressler believes he may have seen it in Costa Rica. Plants from Honduras appear similar to a small, cespitose, rather

broad-leaved variety of *M. variabilis* with brown-purple flowers.

Maxillaria houtteana Rchb. f., Hamb. Gartenz. 14:212. 1858. This species occurs from Mexico possibly to Nicaragua. It was treated (by J. T. A.) as a synonym of *M. curtipes* Hook. f. (Icon. Pl. Trop. 14: t. 1342) based on a collection from Mexico in the belief that it probably occurs in Costa Rica based on the checklist of L. O. Williams (1956), but no specimens south of Nicaragua have been seen. Subsequent examination of the type of *M. curtipes*, rather than photographs, revealed that *M. curtipes* is a synonym of *M. variabilis* Batem. ex Lindl., as suggested by M. Soto A. (pers. comm.).

Mormolyca Fenzl

(J. T. Atwood)

REFERENCES—L. A. Garay & M. Wirth, On the genera *Mormolyca* Fenzl and *Cyrtoglottis* Schltr. Canad. J. Bot. 37:479–490. 1959. L. van der Pijl & C. H. Dodson, Orchid Flowers. University of Miami Press, Coral Gables, Florida. 214 pp. 1966.

Epiphytic cespitose or rhizomatous and creeping herb. Pseudobulbs ovoid or elongate, variously compressed. Leaves 1–4 at the pseudobulb apex, none at the base, conduplicate, chartaceous to coriaceous, linear to elliptic-oblong. Scapes 1-flowered, laterally produced at the base of the pseudobulb, elongate, usually with the internodes exposed between bracts; ovary distinctly pedicellate, at least in the Central American species. Flowers ringent, usually with rather lurid colors. Sepals similar or dissimilar, never connate. Petals similar or dissimilar to the sepals. Lip simple or 3-lobate, often with appearance of an insect. Column stout or slender; pollinia 4, usually without a stipe (stipe present in at least 1 South American species) but supported on a viscidium. Fruit a capsule.

A Neotropical genus of about six species. The primary distinguishing feature of *Mormolyca* is the footless column, although one could argue that a foot is actually present that does not extend beyond the receptacle. The flowers appear adapted for pseudocopulation, although the author is unaware of any observations of natural pollination. Only a single species is known in Central America (see note under *Maxillaria piestopus* Schltr.).

Garay and Wirth (1959) suggested that *Mormolyca* and related *Trigonidium* may prove inseparable from *Maxillaria*, a view also held by one

of us (J. T. A.). The heavily veined leaves, cespitose pseudobulbs lacking foliaceous sheaths at the base, obsolete column foot, usually sharp lateral lobes of the lip, and distinctly pedicellate ovaries strongly suggest a relationship with the *Maxillaria rufescens* complex.

Mormolyca ringens (Lindl.) Schltr., Die Orchideen 436. 1914. *Trigonidium ringens* Lindl., Edwards's Bot. Reg. 26: misc. 57. 1840. TYPE: Mexico, *Hartweg* (κ, photo seen). *Mormolyca lineolata* Fenzl, Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. Figure 26A.

Plant a cespitose epiphyte to about 40 cm tall. Rhizome short, roots to 2.5 mm in diameter. Pseudobulbs ovoid, congested, smooth when turgid, rugose if at all dehydrated, somewhat compressed, 2-4 cm long, 1.5-4 cm wide, subtended by fugaceous, nonfoliaceous bracts, apex 1-foliate. Leaves coriaceous and strongly veined above, shortly petiolate, elliptic, acute, 9.5-44 cm long, 1.3-5.5 cm wide. Inflorescence 1 or more per shoot, lateral, wiry, with 5-7 appressed bracts including the floral bract, internodes conspicuously exposed; ovary with pedicel 3-4.5 cm long, the pedicel 2.25-3.6 cm long, subtended by a floral bract 7-12 mm long. Flowers ringent, not very variable, with petals pointing upward and parallel with the dorsal sepal, lateral sepals pointing downward and parallel to each other, greenish aging tan, veined with red; lip with maroon callus at base. Sepals dissimilar; dorsal concave, elliptic acute to shortly acuminate, 1.4-1.6 cm long, 7-8 mm wide; lateral convex, elliptic-falcate, 1.5-1.7 cm long, 5.5-7 mm wide, with apex bluntly acute and somewhat recurved. Petals similar to the lateral sepals but smaller, somewhat convex, elliptic-falcate, somewhat twisted, 1.3-1.5 cm long, 4-5 mm wide, apex obtuse and acuminate. Lip porrect and parallel with the column, somewhat velvety, 3-lobate below the middle, elliptic-rhombic in general outline, 7-8 mm long when spread, 4-6 mm across the lateral lobes; lateral lobes short, triangular, and acute; midlobe recurved apically; calli 2, the first at the base triangular, velvety, a second callus at the middle, somewhat elevated and horseshoe-shaped in front. Column arcuate, clavate, essentially lacking a foot, 8 mm long without anther, anther ca. 1 mm long; pollinia 4, with horseshoe-shaped viscidium.

Epiphytic on larger branches of evergreen to semideciduous forests; usually common locally in the northern parts of its range. Flowering probably throughout the year. Widespread from Mexico to at least northern Costa Rica.

Mormolyca ringens is easily recognized throughout its range by the unifoliate, clustered pseudobulbs and wiry scapes supporting rather gaping, greenish to tan flowers marked with red and maroon. Even sterile specimens should be easily distinguished if old scapes are present.

Trigonidium Lindl.

(J. T. Atwood)

Epiphytic or lithophytic, cespitose or rhizomatous and creeping herb. Pseudobulbs ovoid or elongate, variously compressed laterally. Leaves 1–5 at pseudobulb apex, none at the base, conduplicate, chartaceous to coriaceous, linear to elliptic-oblong. Scapes elongate, bracteate, 1-flowered, produced at the base of the mature pseudobulb or immature shoot. Flowers campanulate, appearing triangular from the front, usually more or less brown with petal apices metallic blue to white. Sepals similar when spread. Petals much smaller than sepals. Lip 3-lobate, shorter than lateral petals, and with a simple callus. Column nearly straight, wingless, forming at most a very short foot at the base; pollinia 4, waxy. Fruit a capsule.

A perplexing Neotropical genus of perhaps 12 species differing mainly in floral size and growth habit. Three species are known in Central America, all in Costa Rica.

The relationships of *Trigonidium* with the rest of the Maxillariinae are unclear, but there are vegetative and floral similarities with some of the Brazilian species of *Maxillaria* (*M. picta* group). *Trigonidium* itself is probably monophyletic, held together by the similar and rather odd floral apomorphies such as the campanulate presentation of the perianth and shiny spot on the petal apex.

Key to the Species of Trigonidium

Trigonidium egertonianum Bateman ex Lindl., Edwards's Bot. Reg. 24: misc. p. 73. 1838. TYPE: Honduras, G. U. Skinner (holotype: к, photo seen). Trigonidium seemannii Rchb. f., Seem. Bot. Voy. Herald. 214. 1854. TYPE: Panama, Seemann s.n. (holotype: w). Figure 26B.

Plant a cespitose epiphyte often forming massive clumps. Roots velamentous, to 2.5 mm in diameter. Pseudobulbs approximate, ovoid in outline, somewhat laterally flattened, apically 2-foliate, 4.5-7 cm long and 1.7-3 cm wide, with several longitudinal grooves becoming more apparent on drying, invested basally by several nonfoliaceous bracts. Leaves 2 at the pseudobulb apex, narrowly oblanceolate, arcuate near the apex in live material, acute, 30-48 cm long and 1.2-2.5 cm wide. Inflorescence 1-flowered, arising laterally at the base of the most recently completed shoot on peduncles 25-45 cm long, covered by 8-10 closely appressed tubular sheaths; ovaries with pedicels 4.7–7 cm long. Flowers green to orange, faintly reticulated with purple thus appearing brown, the petals provided with a metallic blue spot near the apex. Sepals closely appressed at the base but broadly expanded apically, quadrate to obovate, acuminate, 3-4 cm long and 1-2 cm wide. Petals lanceolate, acute, shortly clawed, 1.5-2 cm long and 4-6 mm wide. Lip 8–10 mm long with 3 lobes diverging above the middle; lateral lobes turned upward around the column and provided centrally with a ligulate callus; apical lobe orbicular, verrucose, and reflexed. Column terete, 4-6 mm long.

Epiphytic on larger branches of trees of evergreen or less often semideciduous forests at 0–1000 m; rarely lithophytic; usually common. Flowering in November to June. Widespread from Mexico into South America.

Trigonidium egertonianum resembles closely T. riopalenquense Dodson, with which it occasionally occurs on the same host. They are best distinguished by the length of the ovary with the pedicel and by the habit of flowering either on completed growth (T. egertonianum) or on immature growth (T. riopalenquense). Leaf width is helpful in determining sterile specimens, but a depauperate plant of T. egertonianum could easily be misdetermined as T. riopalenquense on this feature alone.

Trigonidium seemannii Rchb. f. is here interpreted as a synonym of T. egertonianum. The holotype of T. seemannii (w) consists only of a drawing of a scape and flower, but only T. egertonianum is known from the type locality, low-land central Panama. Furthermore, Reichenbach intended the name T. seemannii to replace T. egertonianum, a species with a description he believed to be defective. Described from Honduran material, T. egertonianum is the only species of Trigonidium known north of Nicaragua.

Trigonidium lankesteri Ames, Sched. Orch. 5: 32–34. June 1923. TYPE: Costa Rica, Lankester 367 (holotype: AMES). Trigonidium amparoanum Schltr., Repert Spec. Nov. Regni Veg. Beih. 19:61. Nov. 1923. TYPE: Costa Rica, Carillo, C. Wercklé 26 (not found). Trigonidium insigne of authors. Not Rchb. f. ex Benth. & Hook. Figure 26D.

Plant conspicuously rhizomatous, the ascending shoots more than 15 cm apart; roots to about 1.5 mm in diameter. Pseudobulbs conical to cylindrical, to about 8 cm long, sheathed basally with obtuse sheaths about 2 cm long, apically 3-5 foliate. Leaves imbricate basally, thin, coriaceous, elliptic-oblong to elliptic-lanceolate, 18-28 cm long and 2.5-4(5) cm wide, shortly petiolate. Inflorescence a solitary flower borne on a scape concealed by imbricating bracts and rising from the base of the most recently formed shoot. Flowers large for the genus, brown. Sepals 4.5-6 cm long and 1.5-2 cm wide, connivent basally, sharply reflexed above the middle, acute apically. Petals elliptic-oblanceolate, about 2.5 cm long, thickened apically. Lip 1.4 cm long and about 5 mm wide, 3-lobate apically, the lateral lobes erect, the midlobe minutely glandular; callus bilobed. Column about 1 cm long.

An uncommon and striking epiphyte of tropical and premontane rain forests from Costa Rica to South America to about 1000 m. Flowering August and September.

The large flowers, ascending rhizomatous habit, and apically 3–5-foliate pseudobulbs readily distinguish this species from others. *Trigonidium lankesteri* also occurs at higher elevations. The name *T. insigne* Rchb. f. ex Benth. & Hook. f. has been misapplied to South American plants that appear to be *T. lankesteri*. The holotype of *T. insigne* based on a Colombian specimen collected by Purdie (K) is a large plant related to and probably conspecific with *T. egertonianum* Batem. ex Lindl.

Trigonidium riopalenquense Dodson, Selbyana 2:56. 1977. TYPE: Ecuador, Los Ríos, *Dodson 5251* (holotype: SEL). Figure 26C.

Plant a cespitose epiphyte, sometimes shortly creeping, rarely forming large clumps. Roots velamentous, to 2 mm in diameter. Pseudobulbs approximate, even when exhibiting a creeping habit, ovoid, compressed, rarely conical, with furrows formed rather irregularly on drying, 2–3.5 cm long and 1.7–2.3 cm wide, 2-foliate, sheathed basally by 2 or more bracts disintegrating with age. Leaves linear to very narrowly oblanceolate, acute, 30–40 cm long and 0.6–1.2 cm wide. Inflorescences lateral, 1-flowered, arising from the axil of a bract protecting the immature shoot, supported on a peduncle 17–25 cm long covered by 7–9 closely appressed bracts;

ovary with pedicel 4–4.5 cm long. **Flowers** greenish to pinkish yellow to brown. **Sepals** rhombic, obovate, acuminate, 2.8–3.4 cm long and 1–1.5 cm wide. **Petals** with a metallic blue "eye" apically, lanceolate, acute, 1.5 cm long and 5–6 mm wide. **Lip** 6–8 mm long, with 3 lobes diverging above the middle, the lateral lobes turned upward around the column, the apical lobe orbicular, verucose, and reflexed, with a ligulate callus on the lower half. **Column** terete, 4–5 mm long. Capsule ellipsoid, about 3 cm long.

Uncommon epiphytes of lowland humid tropics from Nicaragua to Ecuador but easily confused with *T. egertonianum* (see notes under that species). Flowering in Costa Rica from August to October.

Subtribe Oncidiinae Benth.

References—M. W. Chase, A reappraisal of the Oncidioid orchids. Syst. Bot. 11:477-491. 1986. M. W. Chase & J. D. Palmer, Floral morphology and chromosome number in subtribe Oncidiinae (Orchidaceae): Evolutionary insights from a phylogenetic analysis of chloroplast DNA restriction site variation. In P. S. Soltis, et al., Molecular Systematics of Plants. Chapman and Hall, New York, New York, pp. 324-337. 1992. R. L. Dressler, The Orchids. Harvard University Press, Cambridge, Massachusetts, and London, England, 332 pp. 1981. R. L. Dressler, Phylogeny and Classification of the Orchid Family. Dioscorides Press, Portland, Oregon, 314 pp. 1993. L. O. Williams, An enumeration of the Orchidaceae of Central America, British Honduras and Panama. Ceiba 5: 1-256. 1956.

Plant usually an epiphytic herb, rarely terrestrial or more commonly opportunistically terrestrial. Rhizomes short or variously elongate; roots with white velamen, variously thickened. Pseudobulbs usually present, of a single internode, sheathed at the base with articulate foliaceous bracts or by nonfoliaceous and nonarticulate bracts; apex of 1-several leaves. Leaves thin to fleshy, conduplicate and flat, less often equitant or terete, articulate or less often nonarticulate, linear to elliptic, petiolate to nonpetiolate. Inflorescence a raceme, panicle with various patterns of branching, or less often a scape with solitary flower; ovary usually with long pedicel. Flowers usually complex in form and color pattern, color various but perianth segments often marked with maroon, red, or brown. Sepals similar or dissimilar, often concave, often unguiculate, the laterals often variously connate. Petals usually large and showy, sometimes larger than the sepals, sometimes unguiculate. Lip simple to complexly lobed, with complex calli consisting of various plates and tubercles. Column usually complex,

often with a plate ventrally near the base (tabula infrastigmatica), often complexly winged above; anther with 2 pollinia with stipe of varying length and a viscidium. Fruit a capsule.

An exclusively Neotropical subtribe of about 77 genera and more than 1,200 species. Thirty-five genera are known in Costa Rica with a total of 112 species.

The Oncidiinae is best developed in South America and grows in wet to nearly desert habitats from sea level to more than 3500 m. Although rather well defined as a subtribe, the genera within it are particularly problematic, especially the genus *Oncidium*, which is defined on the basis of plesiomorphic character states, including the obtuse angle formed by the column and lip.

Key to Subtribe Oncidiinae

1a. Leaves laterally flattened (equitant) 2 2a. Stems elongate; plant never fanlike 3 3a. Plants creeping monopodials 4 4a. Flowers white to green, segments < 5 mm Pachyphyllum 4b. Flowers red to purple, segments > 5 mm long Fernandezia (tica) 3b. Plants never creeping Lockhartia 2b. Stems not elongate, plant fanlike 5 5a. Sepals and petals narrowly lanceolate to attenuate, "spidery" Macroclinium 5b. Sepals and petals elliptic to ovate, never "spidery" 6 6a. Inflorescence a panicle of subumbels; floral segments < 3.5 mm long Trizeuxis (falcata) 6b. Inflorescence never subumbellate; floral segments > 3.5 mm long Psygmor-
chis
1b. Leaves not laterally flattened, either dorso-ventrally flattened or terete
7a. Plant monopodial, usually creeping
8a. Flowers red to purple, segments > 5 mm long Fernandezia (tica)
8b. Flowers white to green, segments < 5 mm
9a. Spur, chin, or column foot present
10a. Only 1 leaf per shoot
11a. Basal side margins of lip as well as petals embracing the column
Plectrophora (alata)
11b. Neither lip base nor petals embracing the column Trichocentrum
10b. Leaves 2 or more per shoot
12a. Appendage present at base of lip; may be enclosed in sepaline spur 13
13a. Appendage of lip single, undivided Rodriguezia (compacta)
13b. Appendages of lip either 2 or 1 and furcate at apex
14a. Flower red; appendages of lip 2, about as long as blade of lip
14b. Flower yellow; appendage of lip divided near apex, much shorter
than blade Scelochilus (aureus)
12b. Appendage absent at base of lip
15a. Column foot conspicuous, broad; flowers green; blade of lip much
shorter than sepals
15b. Column foot inconspicuous; flowers either white or lavender, never
green; lip much longer than sepals
16a. Lip partially adnate to, or the basal margins embracing the column, sometimes
in-rolled and forming a tubular base
17a. Lip clearly 3-lobate with sharp sinuses between the lobes, the midlobe much
narrower than the lateral lobes
18a. Flowers white; lip and petals denticulate Warmingia (margaritacea)
ten tiente mini, ir ma peans democrate

	180. Flowers colored, the and persistential Macraaema [unknown but
	expected in Costa Rica; reported from Nicaragua and Panama]
17	b. Lip simple or 3-lobate but with blunt sinuses, or if sharp, then the midlobe
	much broader than the lateral lobes
	19a. Shoots with 1 apical leaf
	20a. Sepals less than 2 cm long; leaf fleshy Leucohyle (subulata)
	[unknown but expected in Costa Rica; reported from Nicaragua
	and Panama]
	20b. Sepals > 2 cm long; leaf thin Trichopilia
	19b. Shoots with leaves at base of pseudobulb in addition to the 1-2 apical
	leaves
	21a. Side lobes of lip not clasping nor in-rolled around the column;
	pseudobulb apex with 2(1) leaves Aspasia
	21b. Side lobes of lip either clasping or in-rolled around the column;
	pseudobulb apex with 1 leaf Cischweinfia
16b. Li	p entirely free from, although sometimes parallel with, the column when viewed
lat	terally
	a. Leaf 1 restricted to pseudobulb apex
	23a. Sepals > 4 cm long
	24a. Dorsal sepal linear; lateral sepals much broader, falcate; petals
	similar to the dorsal sepal, antenna-like
	24b. Sepals all similar Rossioglossum (schlieperianum)
	23b. Sepals < 4 cm long
	25a. < 4 flowers per inflorescence
22	25b. > 4 flowers per inflorescence Oncidium
22	26. Petels broad at least 1.3 are broad reversellers or alivescens.
	26a. Petals broad, at least 1.3 cm broad, never yellow or olivaceous 27
	27a. Flowers mostly chestnut brown Otoglossum (chiriquense)
	27b. Flowers white to pink Miltoniopsis (warscewiczii)
	26b. Petals narrower, < 1.25 cm broad, of various colors
	28a. Lateral sepals ≥ 7.5 cm long, lanceolate Brassia
	28b. Lateral sepals much shorter than 7.5 cm long
	29a. Lip ≥ 2.3 cm long
	30a. Lip more or less acute Rhynchostele
	30b. Lip obtuse, rounded, or emarginate Oncidium
	29b. Lip ≤ 2.2 cm long
	31a. Plant with combination of pseudobulb hidden by sev-
	eral subtending leaves, starlike flowers with narrow
	sepals, the lateral sepals ≥ 1.9 cm long, lip less than
	3/3 the lateral sepals Ada (chlorops)
	31b. Combination of features otherwise
32a. Flowers nonresupir	nate, white or tinged with lavender; the lip with yellow or red on the callus
•	Osmoglossum
32b. Flowers otherwise	
	d by the column and base of $lip \le 30^{\circ}$ when viewed laterally 34
	aple, biblike or flabellate and emarginate, the blade flat, neither with recurved
	urved margins
	ip deeply emarginate or with slightly concave side margins, white to deep lav-
	nder Ionopsis
	ip if emarginate, then with convex side margins, greenish white to yellowish,
	ometimes spotted
	obate, pandurate, or with recurved or incurved margins
	ip 3-lobate, with subtriangular lateral lobes near the middle
30d. Ll	ip 5-100ate, with subtraingular fateral 100es hear the findule

Goniochilus (leochilinus)
36b. Lip otherwise
37a. Lip shorter than lateral sepals Mesospinidium
37b. Lip longer than lateral sepals
33b. Angle formed by column and lip base $> 30^{\circ}$ (often much greater than 60°)
38a. Column stout, less than twice as long as wide
39a. Lip simple, biblike Leochilus
39b. Lip 3-lobate
38b. Column more than twice as long as wide
40a. Inflorescence a pendent, densely flowered raceme; lip simple, arrow-shaped
40b. Inflorescence and lip otherwise
41a. Column slender, arcuate, at least half as long as and usually more than ¾
the lip length
42a. Sepals < 1 cm long Sigmatostalix
42b. Sepals > 1 cm long
41b. Column not slender and arcuate, usually less than ½ the lip length 43
43a. Sepals > 7 mm long
43b. Sepals < 6 mm long Sigmatostalix

Ada Lindl.

(D. E. Mora de Retana)

REFERENCES—L. A. Garay, Orquídeas colombianas nuevas o criticas. Orquideologia 4:14–21. 1969. N. H. Williams, A reconsideration of *Ada* and the glumaceous brassias (Orchidaceae). Brittonia 24:93–110, 1972.

Epiphytic, cespitose or rhizomatous and creeping herb. Pseudobulbs present to obsolete, variously compressed. Leaves several per shoot, 1–2 at pseudobulb apex, chartaceous, conduplicate, with usually several conspicuous veins. Inflorescence a lateral raceme of several flowers, often 2 or more per shoot. Flowers stellate to campanulate with lanceolate to attenuate segments, the lip nearly parallel to the column; pollinia 2, waxy, supported on an obdeltoid stipe and broadly ovate viscidium. Fruit a capsule.

A genus of about 14 currently recognized, mostly South American species; two species in southern Central America, but only one in Costa Rica. The genus is easily recognized by the reduced or absent pseudobulbs, the thin leaves with several prominent veins, and the starry to campanulate flowers borne on lateral racemes.

The DNA evidence of Chase and Palmer supports Williams' separation of *Ada* from closely related *Brassia*. Unfortunately, Chase and Palmer did not sample *Mesospinidium*, which is vegetatively similar to *Ada* but usually has smaller and fewer leaves.

Ada chlorops (Endres & Rchb. f.) N. Williams, Brittonia 24:105. 1972. *Brassia chlorops* Endres & Rchb. f., Gard. Chron. 542. 1873. TYPE: Costa Rica, *Endres* (w). *Brassia parviflora* Ames & C. Schweinf., Sched. Orch. 8:74–75. 1925. TYPE: Costa Rica, Cascajal, *Alfaro s.n.* (holotype: AMES) Figure 27A.

Plant epiphytic, cespitose, forming small clumps to ca. 40 cm tall. Rhizome short; roots 2-3 mm in diameter. Pseudobulbs reduced, ovate-lanceolate, compressed, 3-5 cm long, 1.5 cm wide, covered at the base by the conduplicate sheaths of several leaves, 1-foliate apically. Leaf blades articulate, carinate, subcoriaceous, ellipticlanceolate to obovate, acute, to 34 cm long, 1.3-2.5 cm wide. Inflorescence a lateral, 5-10 flowered raceme, 20-35 cm long including the scape, the latter with appressed, acute, membranaceous bracts; ovary with pedicel 1.5-2.5 cm long, subtended by shorter to longer, triangular, apiculate bracts. Flowers somewhat fleshy, greenish yellow with brown spots. Sepals subequal, free, ovate-lanceolate, acuminate; dorsal erect, 1.5-2.2 cm long, 3-5 mm wide; lateral sepals subfalcate and spreading, 1.9-2.5 cm long, 3-4 mm wide. Petals similar to the sepals, 1.2-1.5 cm long, 2-3 mm wide. Lip oblonglanceolate, acute to acuminate, reflexed above the middle, the base adnate to the column, 1.2-1.4 cm long, 5-6 mm wide; callus fleshy, sulcate and pubescent basally, and with a pair of elevated teeth apically. Column 5-6 mm long, stout, foot lacking; anther terminal, rounded, papillose, with 2 imperfect cells; pollinia 2, pyriform, with subcordate stipe and viscidium. Fruit an ellipsoid capsule ca. 5 cm long.

Epiphytic in premontane and lower montane rain forests mostly at (200)1000-1600(2000) m, where it grows on larger trunks of the host in

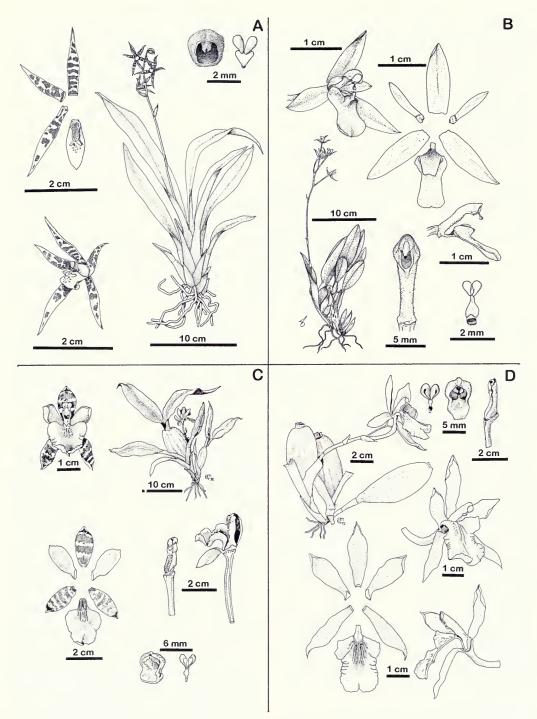


Fig. 27. **A,** Ada chlorops (Icon. Pl. Trop. 16: t. 1501. Illustrator: F. Pupulin). **B,** Amparoa costaricensis (Icon. Pl. Trop. 7: t. 601. Illustrator: O. Achí). **C,** Aspasia epidendroides (Icon. Pl. Trop. 16: t. 1502. Illustrator: C. Marín). **D,** Aspasia principissa (Icon. Pl. Trop. 16: t. 1503. Illustrator: C. Marín).

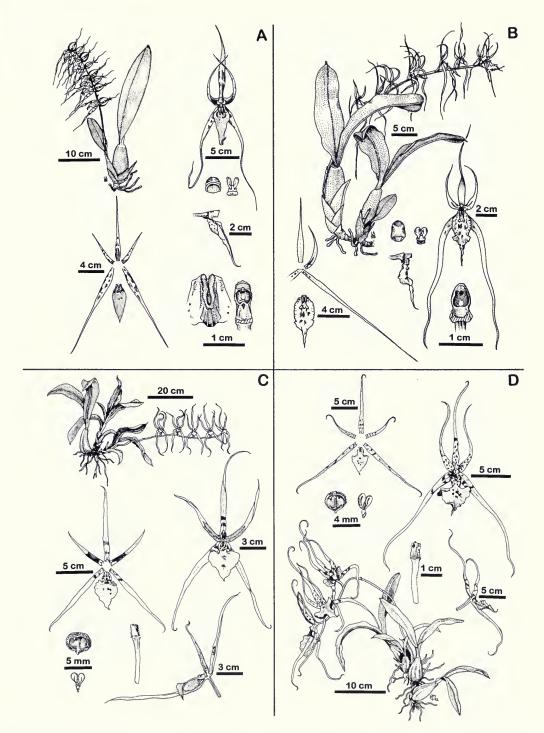


Fig. 28. **A,** Brassia arcuigera (Icon. Pl. Trop. 16: t. 1507. Illustrator: L. Alfaro). **B,** B. caudata (Icon. Pl. Trop. 16: t. 1508. Illustrator: L. Alfaro). **C,** B. gireoudiana (Icon. Pl. Trop. 16: t. 1509. Illustrator: C. Marín). **D,** B. verrucosa (Icon. Pl. Trop. 16: t. 1510. Illustrator: C. Marín).

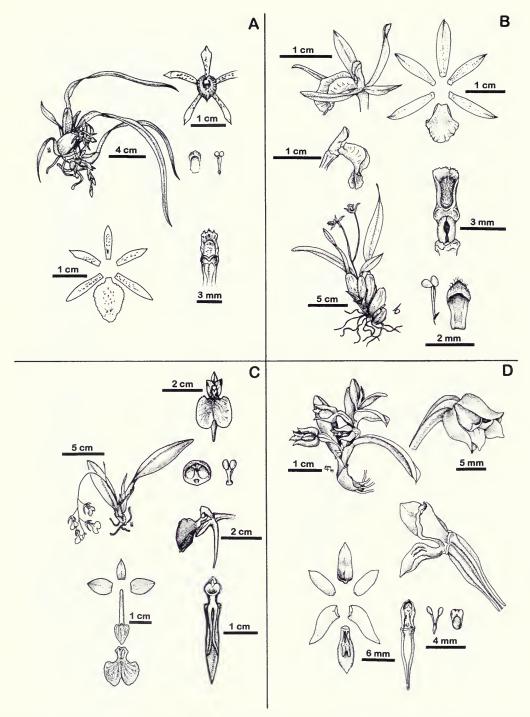


Fig. 29. A, Cischweinfia dasyandra (Icon. Pl. Trop. 15: t. 1413. Illustrator: L. Alfaro). B, Cischweinfia pusilla (illustrator: O. Achí). C, Comparettia falcata (Icon. Pl. Trop. 15: t. 1416. Illustrator: O. Achí). D, Fernandezia tica (Brenesia 39–40:165. 1993. Illustrator: C. Marín).

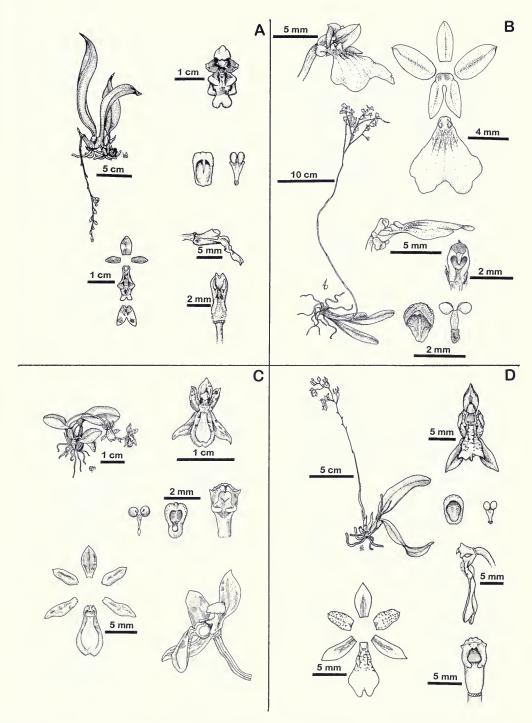


Fig. 30. **A,** Goniochilus leochilinus (Icon. Pl. Trop. 15: t. 1436. Illustrator: L. Alfaro). **B,** Ionopsis utricularioides (illustrator: O. Achí). **C,** Leochilus labiatus (illustrator: C. Marín). **D,** L. tricuspidatus (Icon. Pl. Trop. 15: t. 1443. Illustrator: L. Alfaro).

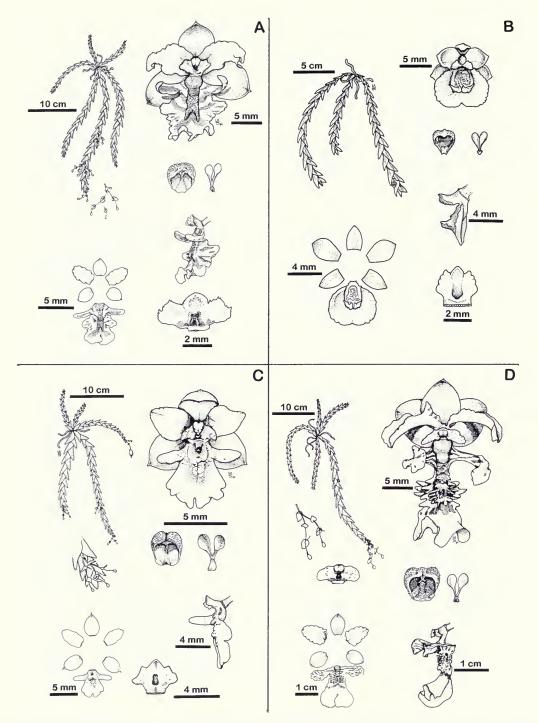


Fig. 31. **A,** Lockhartia amoena (Icon. Pl. Trop. 15: t. 1446. Illustrator: L. Alfaro). **B,** L. hercodonta (Icon. Pl. Trop. 15: t. 1448. Illustrator: L. Alfaro). **C,** L. micrantha (Icon. Pl. Trop. 15: t. 1449. Illustrator: L. Alfaro). **D,** L. oerstedii (Icon. Pl. Trop. 15: 1450. Illustrator: L. Alfaro).

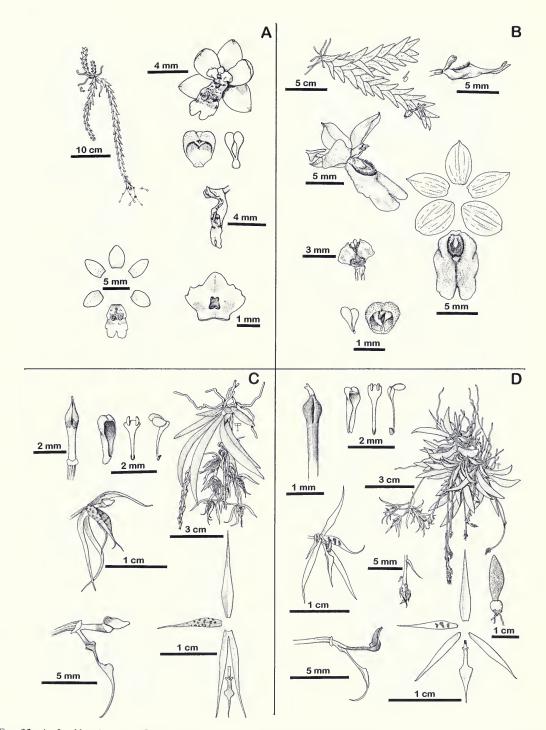


Fig. 32. **A,** Lockhartia acuta (Icon. Pl. Trop. 15: t. 1445. Illustrator: L. Alfaro). **B,** L. pittieri (illustrator: O. Achí). **C,** Macroclinium confertum (Lindleyana 11:139. Illustrator: F. Pupulin). **D,** M. generalense (Lindleyana 11:137. Illustrator: F. Pupulin).

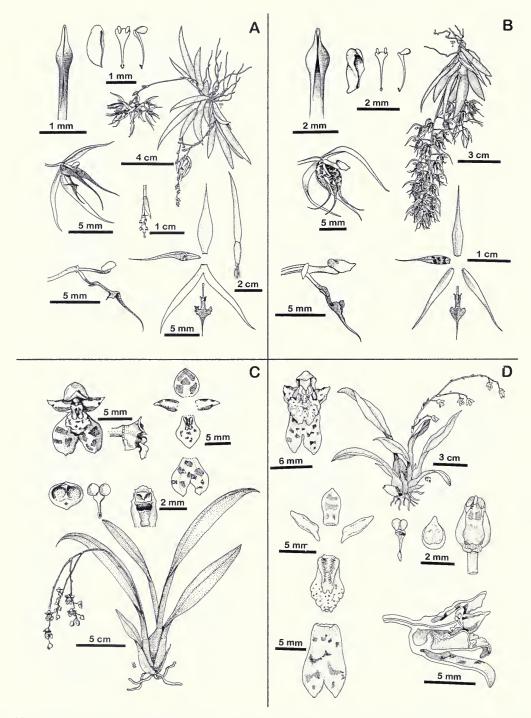


Fig. 33. **A,** Macroclinium cordesii (illustrator: F. Pupulin). **B,** Macroclinium ramonense (illustrator: F. Pupulin). **C,** Mesospinidium horichii (Icon. Pl. Trop. 16: t. 1564, incorrectly as Mesospinidium endresii. Illustrator: L. Alfaro). **D,** Mesospinidium warscewiczii (Icon. Pl. Trop. 16: 1565. Illustrator: C. Marín).

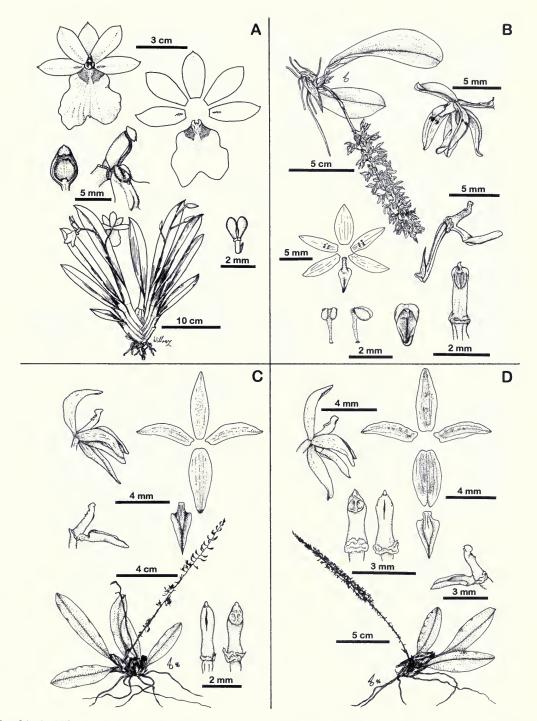


Fig. 34. **A**, *Miltoniopsis warscewiczii* (illustrator: W. Zuchowski). **B**, *Notylia trisepala* (illustrator: O. Achí). **C**, *N. pittieri* (illustrator: O. Achí). **D**, *N. pittieri* (illustrator: O. Achí).

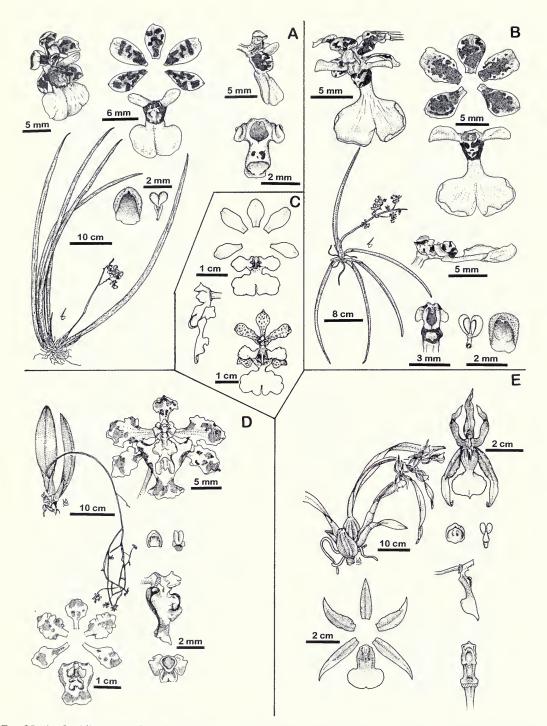


Fig. 35. A, Oncidium ascendens (illustrator: O. Achí). B, O. teres (illustrator: O. Achí). C, O. cebolleta (Icon. Pl. Trop. 15: t. 1467. Illustrator: L. Alfaro). Note: Plant habit is similar to that in Figures 35A, B. D, O. carthagenense (Icon. Pl. Trop. 16: t. 1570. Illustrator: L. Alfaro). E, O. schroederianum (Icon. Pl. Trop. 15: t. 1472. Illustrator: L. Alfaro).

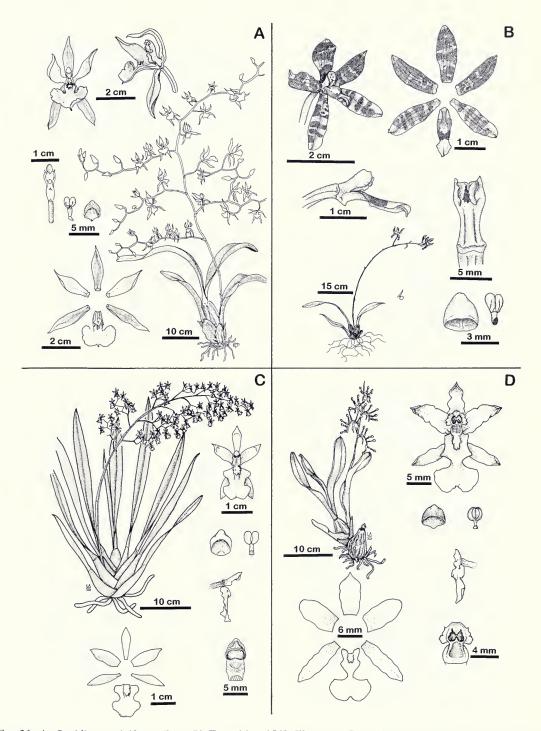


Fig. 36. **A,** Oncidium cariniferum (Icon. Pl. Trop. 16: t. 1569. Illustrator: C. Marín). **B,** O. stenoglossum (illustrator: O. Achí). **C,** O. panduriforme (Icon. Pl. Trop. 15: t. 1471. Illustrator: L. Alfaro). **D,** O. storkii (Icon. Pl. Trop. 15: t. 1474. Illustrator: L. Alfaro).

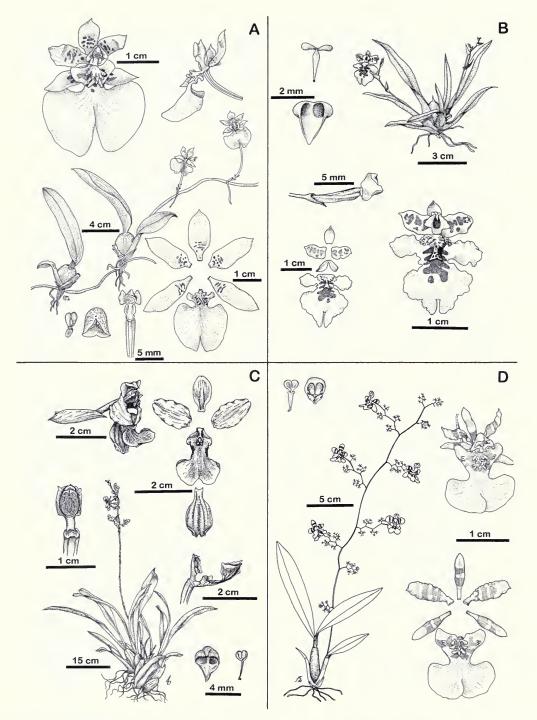


Fig. 37. **A**, *Oncidium globuliferum* (illustrator: C. Marín). **B**, *O. cristagalli* (Icon. Pl. Trop. 16: t. 1571. Illustrator: F. Pupulin). C, *O. warscewiczii* (illustrator: O. Achí). **D**, *O. bryolophotum* (illustrator: S. Dalström).

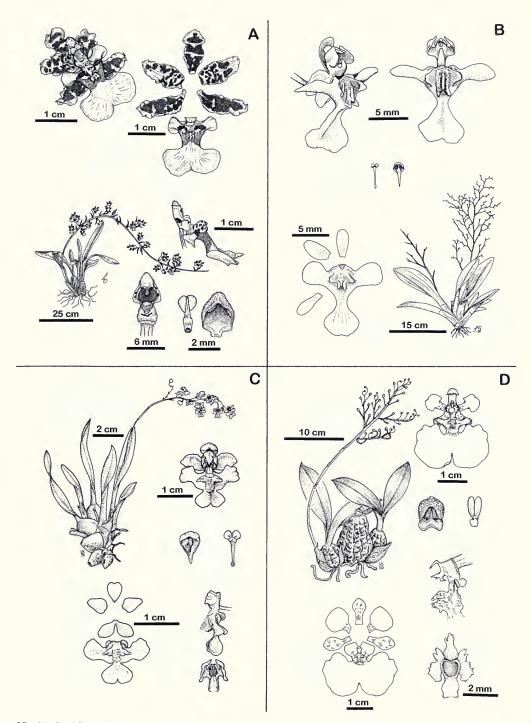


Fig. 38. **A,** Oncidium bracteatum (illustrator: O. Achí). **B,** O. luteum (Icon. Pl. Trop. 16: t. 1572. Illustrator: S. Dalström). **C,** O. cheirophorum (Icon. Pl. Trop. 15: t. 1468. Illustrator: L. Alfaro). **D,** O. ampliatum (Icon. Pl. Trop. 15: t. 1464. Illustrator: L. Alfaro).

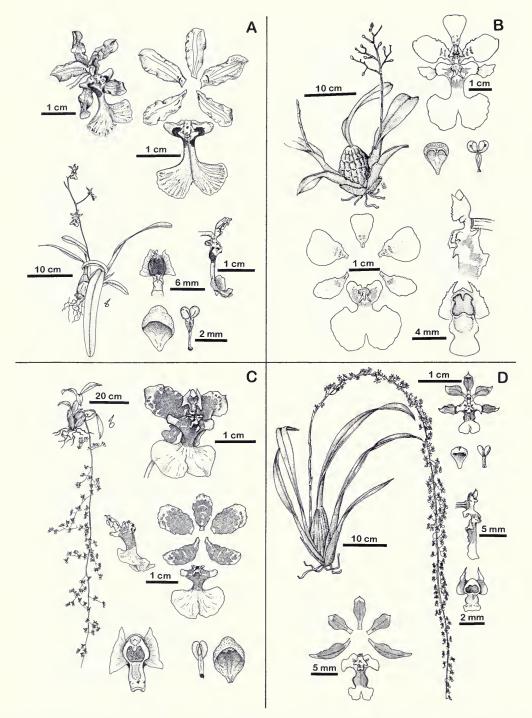


Fig. 39. **A,** Oncidium obryzatoides (illustrator: O, Achí). **B,** O. klotzschianum (Icon. Pl. Trop. 15: t. 1470 as synonym O. obryzatum. Illustrator: L. Alfaro). **C,** O. dichromaticum (Illustrator: O, Achí). **D,** O. parviflorum (illustrator: L. Alfaro).

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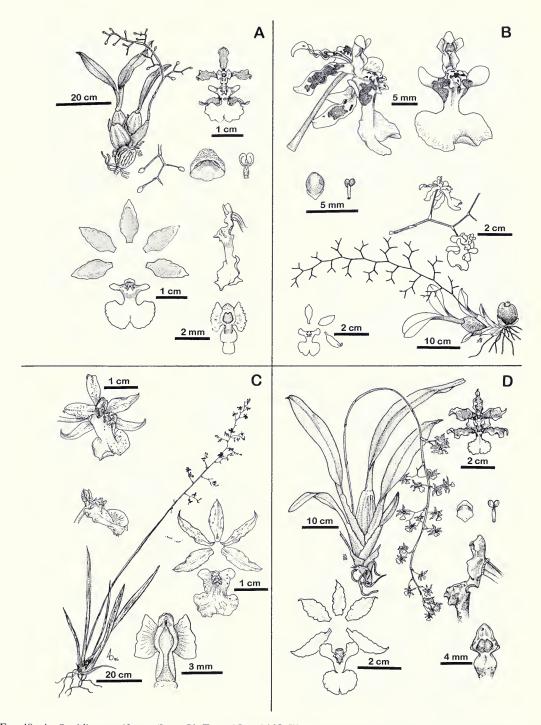


Fig. 40. **A,** Oncidium ansiferum (Icon. Pl. Trop. 15: t. 1465. Illustrator: L. Alfaro). **B,** O. stenobulbon (illustrator: S. Dalström). **C,** O. ensatum (illustrator: O. Achí). **D,** O. stenotis (Icon. Pl. Trop. 15: t. 1473. Illustrator: L. Alfaro).

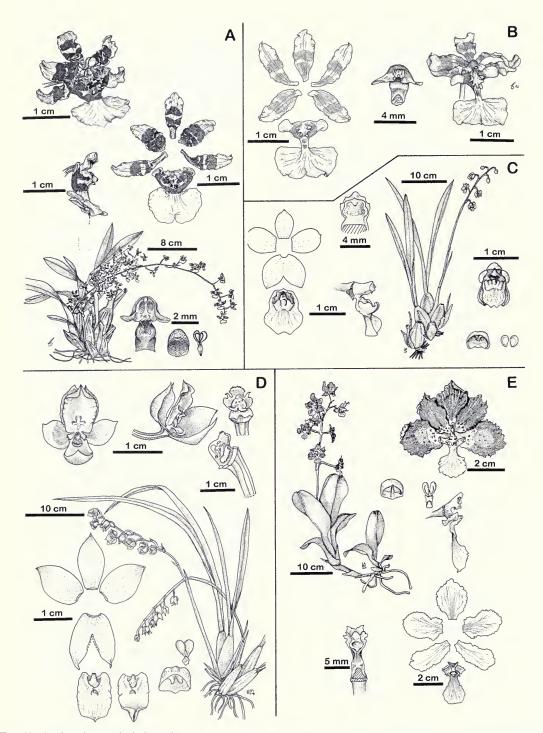


Fig. 41. A, Oncidium polycladium (illustrator: O. Achí). B, Oncidium isthmi (illustrator: O. Achí). Note: Plant habit is similar to that in Figure 41A. C, Osmoglossum convallarioides (Icon. Pl. Trop. 15: t. 1475. Illustrator: L. Alfaro). D, Osmoglossum egertonii (illustrator: C. Marín). E, Otoglossum chiriquense (Icon. Pl. Trop. 16: t. 1573. Illustrator: L. Alfaro).

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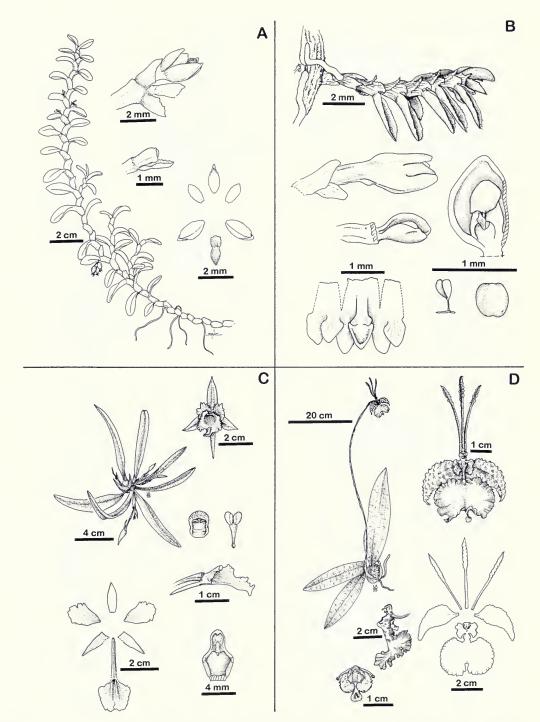


Fig. 42. **A,** *Pachyphyllum crystallinum* (Icon. Pl. Trop. 14: t. 1375 as *P. pastii*. Note: Floral diagnosis is based on a forcefully opened bud. Illustrator: B. N. Culbertson). **B,** *Pachyphyllum hispidulum* (illustrator: S. Dalström). **C,** *Plectrophora alata* (Icon. Pl. Trop. 15: t. 1479. Illustrator: L. Alfaro). **D,** *Psychopsis krameriana* (Icon. Pl. Trop. 15: t. 1486. Illustrator: L. Alfaro).

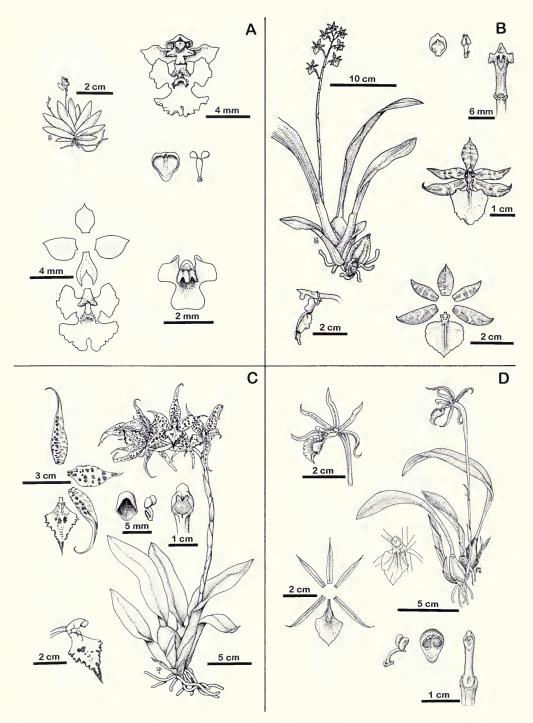


Fig. 43. **A,** Psygmorchis pumilio (Icon. Pl. Trop. 15: t. 1487. Illustrator: L. Alfaro). **B,** Rhynchostele bictoniensis (Icon. Pl. Trop. 15: t. 1442. Illustrator: L. Alfaro). **C,** R. hortensiae (Icon. Pl. Trop. 16: t. 1541. Illustrator: F. Pupulin). **D,** R. stellata (illustrator: C. Marín).

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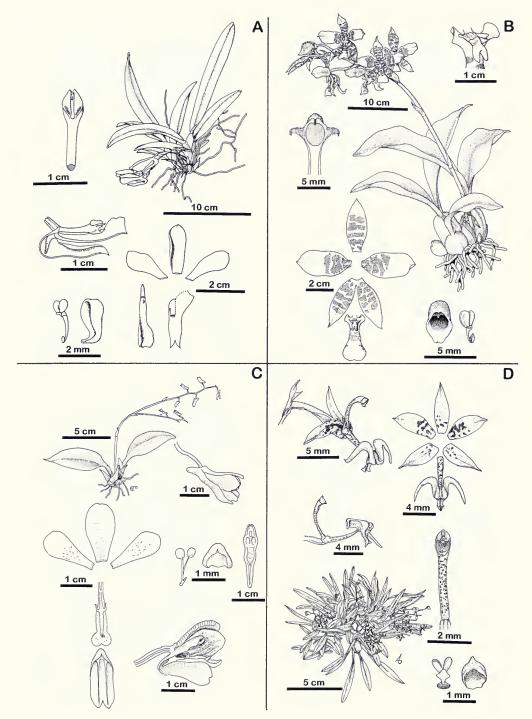


Fig. 44. **A,** Rodriguezia compacta (Icon. Pl. Trop. 16: t. 1578. Illustrator: F. Pupulin). **B,** Rossioglossum schlieperianum (Icon. Pl. Trop. 16: t. 1579. Illustrator: F. Pupulin). **C,** Scelochilus aureus (Icon. Pl. Trop. 16: t. 1585. Illustrator: C. Marín). **D,** Sigmatostalix unguiculata (illustrator: O. Achí).

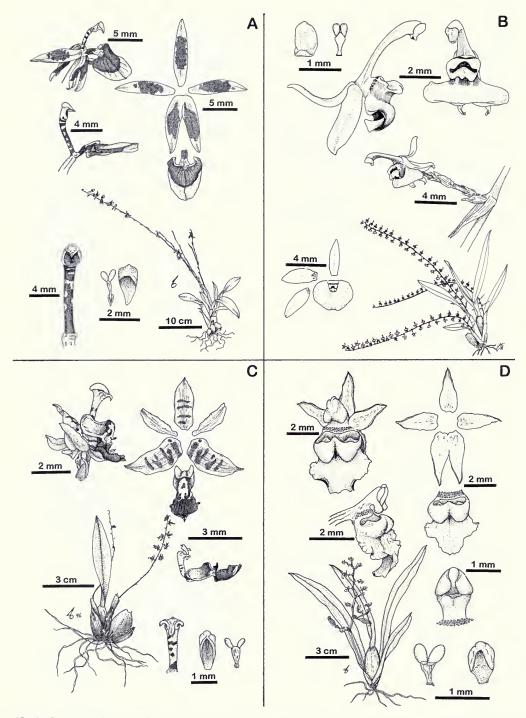


Fig. 45. **A,** Sigmatostalix picta (illustrator: O. Achí). **B,** S. macrobulbon (Icon. Pl. Trop. 16: t. 1588. Illustrator: S. Dalström). **C,** S. brownii (illustrator: O. Achí). **D,** S. hymenantha (illustrator: O. Achí).

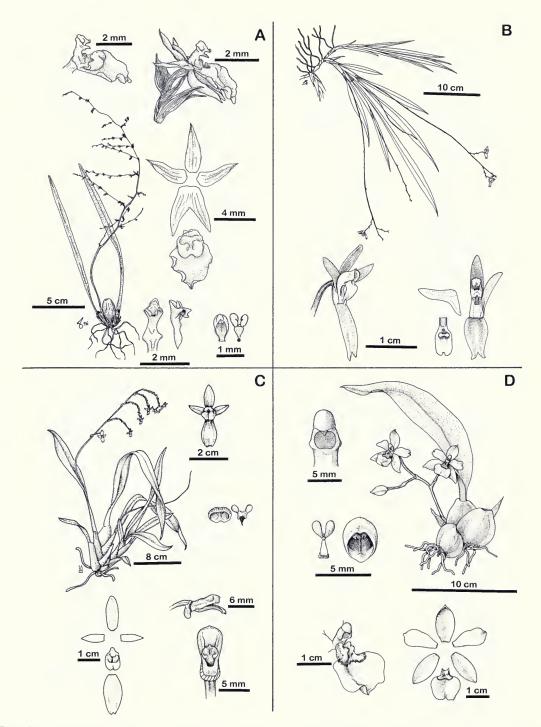


Fig. 46. **A,** Sigmatostalix adamsii (illustrator: O. Achí). **B,** Systeloglossum acuminatum (illustrator: S. Dalström). **C,** Systeloglossum costaricense (Icon. Pl. Trop. 15: t. 1494. Illustrator: L. Alfaro). **D,** Ticoglossum krameri (Icon. Pl. Trop. 16: t. 1596. Illustrator: F. Pupulin).

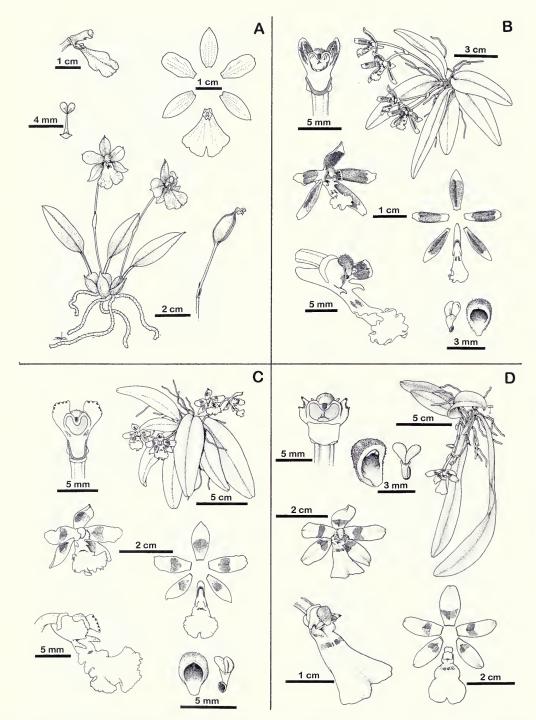


Fig. 47. **A,** *Ticoglossum oerstedii* (Icon. Pl. Trop. 14: t. 1398. Illustrator: B. N. Culbertson). **B,** *Trichocentrum dianthum* (illustrator: F. Pupulin). **C,** *Trichocentrum pfavii* (illustrator: F. Pupulin). **D,** *Trichocentrum estrellense* (illustrator: F. Pupulin).

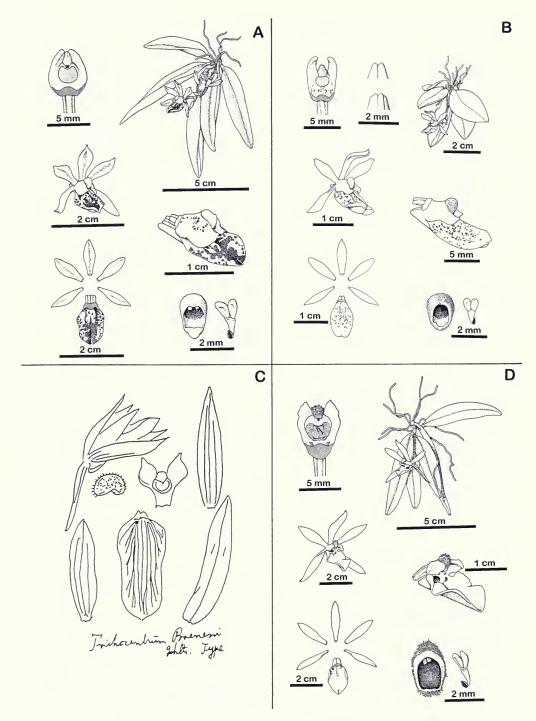


Fig. 48. **A,** *Trichocentrum caloceras* (Icon. Pl. Trop. 16: t. 1597. Illustrator: F. Pupulin). **B,** *T. costaricense* (illustrator: F. Pupulin). **C,** *T. brenesii* (Selbyana 15:97. 1994. Illustrator: F. Pupulin, redrawn from type). **D,** *T. capistratum* (Icon. Pl. Trop. 16: t. 1598. Illustrator: F. Pupulin).

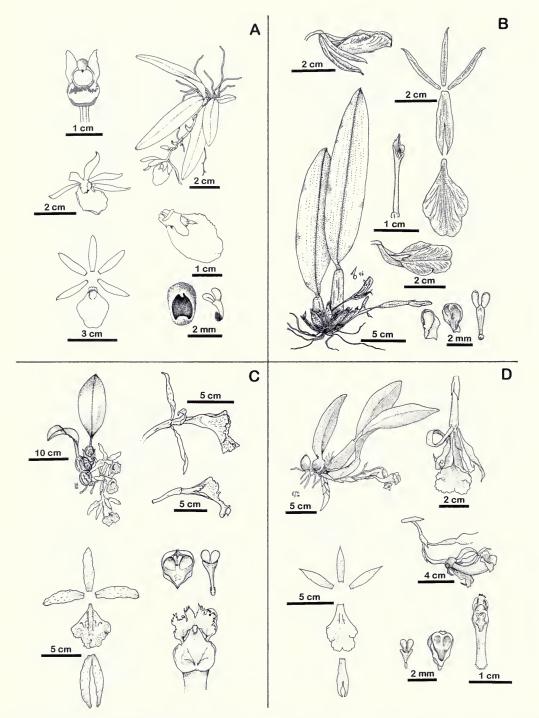


Fig. 49. **A,** *Trichocentrum cymbiglossum* (Selbyana 15: 100. 1994. Illustrator: L. Alfaro). **B,** *Trichopilia maculata* (illustrator: O. Achí). **C,** *Trichopilia suavis* (Icon. Pl. Trop. 15: t. 1498. Illustrator: L. Alfaro). **D,** *Trichopilia turialbae* (Icon. Pl. Trop. 16: t. 1600. Illustrator: C. Marín).

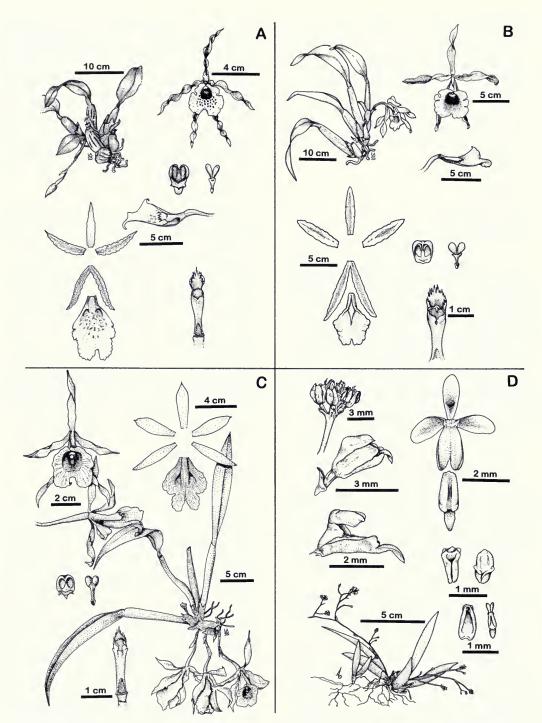


Fig. 50. **A,** *Trichopilia tortilis* (Icon. Pl. Trop. 15: t. 1499. Illustrator: L. Alfaro). **B,** *Trichopilia marginata* (Icon. Pl. Trop. 15: t. 1497. Illustrator: L. Alfaro). **C,** *Trichopilia galeottiana* (Icon. Pl. Trop. 16: t. 1599. Illustrator: L. Alfaro). **D,** *Trizeuxis falcata* (illustrator: O. Achí).

substantial shade. Flowering August to November. Nicaragua to Panama.

Ada chlorops is easy to recognize in the field by the stellate, green flowers spotted with tan on fan-shaped plants with thin, almost plicate leaves. Sterile plants appear similar to Miltoniopsis warscewiczii (Rchb. f.) Garay & Dunsterv., with which it often grows, but the latter has a much more conspicuous pseudobulb, and its leaves are more gray in color.

Amparoa Schltr.

(D. E. Mora de Retana)

Epiphytic, somewhat rhizomatous **herb** with rather thick roots. **Pseudobulbs** ovate, 1-foliate, compressed, subtended by 2 or more foliaceous bracts. **Leaf** oblong-lanceolate to somewhat elliptic, acute, thin in texture. **Inflorescence** a lateral, scapose raceme borne at the base of the pseudobulb, with 5–10 flowers; ovary with slender pedicel. **Flowers** spreading, green or yellowish green, the lip with yellow or orange. **Sepals** soft in texture, oblong-lanceolate, acute. **Petals** similar in shape but notably smaller than the sepals, linear-oblanceolate, porrect, acute. **Lip** somewhat fleshy, simple, straight, subpandurate, with simple callus. **Column** slender, cylindric to subclavate, without auricles; pollinia 2, with stipe and viscidium. **Fruit** a capsule.

A genus of two species ranging from Mexico to Costa Rica. One species occurs in Costa Rica. Schlechter (Repert. Spec. Nov. Regni Veg. Beih. 19:64. 1923) separated *Amparoa* from *Odontoglossum* on the basis of the relatively small petals, rather porrect and straight lip with simple callus, and the slender column. Little is known of its relationships, but the long column suggests a relationship with *Sigmatostalix*.

Amparoa costaricensis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:65. 1923. TYPE: Costa Rica, La Palma, *C. Wercklé 129* (AMES, photo seen). Figure 27B.

Plant a cespitose to shortly creeping epiphyte 20–25 cm high; rhizome thick, to about 2 cm long between pseudobulbs; roots to 2.5 mm thick. Pseudobulbs elliptic-ovate, strongly compressed laterally and with slender margins, 4–4.5 cm long, 2.5–2.7 cm wide, the apex 1-foliate, subtended by ca. 4–6 soon deciduous, foliaceous bracts. Leaves coriaceous, shortly petiolate; blades elliptic-ovate, carinate, conduplicate at the base; apex acute and apiculate. Inflorescence scapose, 20–35 cm long (to 40 cm long in Nicaragua), with 5–10 flowers; ovary with pedicel 2–3 cm long subtended by much shorter acute bracts. Flowers 2–4 open at a time, spreading, yellowish

green, the lip yellow with orange-yellow callus. **Sepals** subequal, oblong-lanceolate, acute, carinate; dorsal 1.3–1.4 cm long, 3–3.4 mm wide; laterals somewhat subfalcate, 1.4–1.6 cm long, 3–3.4 mm wide. **Petals** much smaller than sepals, linear-oblanceolate, porrect, acute, 1–1.1 cm long, 2–3 mm wide. **Lip** simple, subpandurate, 1.3–1.4 cm long, 5–6 mm wide; with a short, semiterete claw at the base; apical portion flat, truncate, and retuse; margins entire; callus on the basal ½ trapezoid, smooth, the base forming "shoulders," the apex emarginate. **Column** slender, broadened above, without auricles, 1–1.1 mm long; anther with 2 pollinia, obovate, sulcate, with ovate stipe and viscidium. **Capsules** ca. 3.5 cm long; pedicel 2–3 cm long.

Middle-canopy epiphytes growing in premontane cloud forests on larger branches exposed to strong winds at 1200–1400 m. Rare from Honduras to Costa Rica. Flowering in August and September.

Vegetatively A. costaricensis is typical of the Oncidiinae, but the inflorescence has few flowers that have a simple lip and a similarly simple callus. The petals are notably smaller than the sepals, and the flower color is unique among Costa Rican Oncidiinae.

Alphonse Heller wrote an unpublished note that he found plants in Nicaragua at 2150 ft with a pubescent callus among other differing features. These plants may represent an undescribed species.

Aspasia Lindl.

(D. E. Mora de Retana)

REFERENCES—R. L. Dressler and N. H. Williams, An overlooked genus in the Oncidiinae. Amer. Orchid Soc. Bull. 39:988–994. 1970. N. H. Williams, Taxonomy of the genus *Aspasia* Lindley (Orchidaceae: Oncidieae). Brittonia 26:333–346. 1974.

Epiphytic, cespitose or shortly rhizomatous and creeping herb. Pseudobulbs stalked, elliptic to oblong, variously compressed laterally, subtended by 2–6 sheathing and often foliaceous bracts. Leaves 1-2 at the pseudobulb apex, conduplicate, usually thin. Inflorescence 1-2, lateral at the base of the pseudobulb, usually not exceeding the shoot, of 1-10 flowers. Flowers usually ringent, the base of the lip parallel to and partially united to the column by the lateral margins. Sepals and petals similar, the petals somewhat smaller and usually partially adnate to the column. Lip larger than sepals and petals (at least in Central American species), recurved or reflexed sharply above the claw, the callus of keels, or teeth, usually 3-lobate, the midlobe often emarginate. Column erect, cylindric; anther with 2 pollinia, waxy, with angular-ovate stipe with viscidium.

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A genus of about six species from lower elevations differing mainly in flower size and in details of the column and lip. Two species are known in Central America, both in Costa Rica.

Williams compared Aspasia to several genera, including Brassia, and Odontoglossum. Dressler

and Williams removed Aspasia pusilla C. Schweinf. to the genus Cischweinfia. Chase and Palmer's work suggests a relationship with a cluster of genera including Ada, Brassia, Cischweinfia, Odontoglossum, Otoglossum, and Symphyglossum.

Key to the Species of Aspasia

1a. Sepals < 2.5 cm, brown spotted	A. epidendroides
1b. Sepals > 2.6 cm, lined with brown	A. principissa

Aspasia epidendroides Lindl., J. Bot. (Hooker) 1:6. 1834. TYPE: Panama and western Colombia, *Cuming s.n.* (K, photo). *Odontoglossum aspasia* Rchb. f., Ann. Bot. Syst. 6:851. 1864. *Aspasia fragrans* Klotzsch, Ind. Sem. Hort. Berol. 12. 1853. *Aspasia barclayi* Rolfe, Bull. Misc. Inform. 210. 1892. Figure 27C.

Plant epiphytic, cespitose to shortly repent, forming small clumps. Rhizome stout; roots 1-1.5 mm in diameter. Pseudobulbs oblong-elliptic, strongly compressed laterally, 4-16 cm long, 4-6 cm wide, somewhat stipitate and hidden basally by 2-4 foliate sheaths, apically 2-foliate. Leaves articulate, the blade elliptic to lanceolate, conduplicate at the base and apically acute to acuminate, 8–30 cm long, 1.5–4.5 cm wide. Inflorescences generally 2 borne laterally at the pseudobulb base, with 4–8 successive flowers, shorter than the subtending leaf; ovary with pedicel 2-3 cm long. Flowers fragrant, the sepals green spotted with maroon, petals rose, and lip white, turning yellow with purple stain centrally. Sepals subequal, subcoriaceous, elliptic-ovate to obovate, somewhat concave, acuminate apically, 2.1-2.3 cm long, 8-10 mm wide; dorsal erect and inserted on the column; lateral-spreading and reflexed. Petals spreading, ellipticovate, somewhat spatulate, apiculate, adnate basally to the column, 2.1-2.3 cm long, 9-10 mm wide. Lip adnate to less than 1/3 the column, lightly 3-lobate, reflexed below the middle, 2–2.5 cm long, 1.5–2.5 cm wide, the margin lightly undulate, the apex emarginate and somewhat fimbriate; callus of 2 fleshy, longitudinal, elevated projections centrally, usually flanked by 2-4 shorter, more or less parallel calli. Column stout, somewhat arcuate, (1.7–)2.3 cm long; anther terminal, the anther papillose; pollinia 2, obpyriform, waxy, with prominent stipe and viscidium. Capsule 6-8 cm long, cylindric, pedicel 1-1.5 cm long.

A fairly common epiphyte of humid forests on larger branches and trunks at 0–750(1000) m along the Pacific slope. Flowering January to April. Reported from Guatemala and El Salvador to Colombia.

This species is easily distinguished from the similar A. principissa Rchb. f. by the smaller

flowers, the spotted sepals and petals, and the lip, which has a darker purple color. The synonymy is based on Williams's treatment.

Aspasia principissa Rchb. f., Bot. Zeitung (Berlin) 10:637. 1852. TYPE: Panama, Veraguas(?), Warscewicz (w 45457, photo). Odontoglossum principissa (Rchb. f.) Rchb. f., Ann. Bot. Syst. 6:852. 1864. Aspasia epidendroides Lindl. var. principissa (Rchb. f.) P. H. Allen, Ann. Missouri Bot. Gard. 36:165. 1949. Aspasia bibriana Rchb. f., Bonplandia 2:90. 1854. TYPE: Locality unknown (w). Odontoglossum biberianum [sic] (Rchb. f.) Rchb. f., Ann. Bot. Syst. 6:849. 1864. Aspasia rousseauae Schltr. Gartenflora 72:76. 1922. (lectotype: fig. 10 in Gartenflora 72:73). Figure 27D.

Plant epiphytic, to 40 cm high. Rhizome short; roots about 1.5 mm in diameter. Pseudobulbs oblong elliptic, compressed, stalked, 7.8-15 cm long, 3.1-3.6 cm wide, concealed at the base by 2-3-foliaceous sheaths, apically 2-foliate. Leaves subcoriaceous, deciduous, elliptic-lanceolate to oblanceolate, conduplicate at the base, acute, the blade 10-41 cm long, 1.3-3.8 cm wide. Inflorescence a lateral 4-6 successive-flowered raceme; ovary with pedicel about 3 cm long subtended by subulate bracts to 1.4 cm long. Flowers about 4.5 cm high and 2.5 cm wide in natural position, with greenish yellow sepals and petals; sepals with diffused bars of reddish brown, the petals longitudinally marked with the same color; lip white turning yellow, stained centrally or lined with magenta and with a yellow callus. Sepals subequal, elliptic-lanceolate, lightly concave, apiculate and thickened at the apex; dorsal erect, inserted on the back of the column, 2.8-3 cm long, 7-9 mm wide. **Petals** elliptic-lanceolate, carinate, enlarged and involute apically, united to the base of the column, the apex emarginate, and with a fleshy apicule; lateral sepals subfalcate, with lightly undulate margins, 2.6 cm long, 7 mm wide. Lip pandurate when spread, united to nearly ½ the column, 2.5-3.5 cm long, 2-2.8 cm wide; callus of a pair of fleshy lamellate keels from the base to about the middle. Column stout lacking wings apically, 2-2.5 cm long; anther terminal, the anther lightly papillose; pollinia 2, obovoid with well-developed stipe and viscidium. Capsule cylindric, about 8 cm long, with pedicel about 1.5 cm.

Epiphytic in lowland tropical rain forests between 10 and 300(500) m on the Atlantic slope, where it grows on the larger, shaded branches of the host. Flowering December to April. Reported from Nicaragua(?), Costa Rica, Panama, and Colombia.

This species closely resembles A. epidendroides but differs in the larger flower, in the sepals and petals with brown lines rather than spots, in the much more constricted lip, and in the much deeper anther. The synonymy given above follows that of N. Williams.

Brassia R. Br.

(D. E. Mora de Retana)

REFERENCE—N. H. Williams, A reconsideration of *Ada* and the glumaceous brassias (Orchidaceae). Brittonia 24:93–110. 1972.

Cespitose or repent epiphytic herb, usually with well-developed pseudobulbs subtended by sometimes foliaceous bracts, the apex with 1–3 leaves. Leaves conduplicate, lanceolate, elliptic to oblanceolate. Inflorescence an arcuate, several- to many-flowered raceme borne laterally at the base of the pseudobulb. Flowers large and conspicuous, subtended by small elongate spathaceous bracts. Sepals free, narrowly attenuate to caudate, sometimes of equal length but usually the dorsal much shorter. Petals similar to the dorsal sepal but usually shorter. Lip simple or obscurely lobed, forming more than a right angle with the column. Column short, stout, and erect, lacking wings; anther terminal, pollinia 2, waxy. Fruit a capsule.

A Neotropical genus of about 38 species differing from *Oncidium* mainly by its attenuate floral segments. Four species are known in Costa Rica. Norris Williams separated plants once assigned to the glumaceous section of *Brassia* into the genus *Ada* on the basis of the smaller pseudobulbs, leaves with several major veins, the often several inflorescences per shoot, the large sheathing leaves, and different pollinarium. According to Chase and Palmer, DNA evidence suggests relationships with *Aspasia, Cischweinfia*, and possibly some species of *Odontoglossum* and *Symphyglossum*.

Key to the Species of Brassia

Brassia arcuigera Rchb. f., Gard. Chron. (1869) 388. TYPE: Peru, Veitch (w, photo). Brassia antherotes Rchb. f., Gard. Chron. 12:782. 1879. TYPE: Colombia, Dagua, E. Klaboch (w, photo). Brassia lawrenceana Lindl. var. longissima Rchb. f., Gard. Chron. 1313. 1868. TYPE: Buller s.n. (w, photo). Brassia longissima (Rchb. f.) Nash, Bail. Stand. Cyclop. Hort. 1:541. 1914. Brassia antherotes Rchb. f. var. longissima (Rchb. f.) Teuscher, Baileya 9:121–124. 1961. Figure 28A.

Plant epiphytic, rarely terrestrial, cespitose, forming small clumps to ca. 40 cm. Rhizome short; roots to 3 mm in diameter. **Pseudobulbs** ovoid to elliptic-oblong, strongly

compressed laterally and sharp-edged, 6-14 cm long, 2.5-4.5 cm wide, apically 1-foliate, protected at the base by 0-1 foliaceous sheaths. Leaves articulate, subcoriaceous, elliptic, conduplicate at the base, acute, prominently keeled abaxially, 20-40 cm long, 4-6 cm wide. Inflorescence an arcuate raceme with numerous flowers borne at the base of the pseudobulb, 25-45 cm tall including the scape, the nodes with triangular acute bracts; ovary with pedicel 1.5-3 cm long. Flowers "spidery" in shape, very variable in size, pleasantly fragrant in Costa Rican populations, distichous, greenish white turning orange-yellow, with reddish brown spots at the base of the sepals, to 30 cm tall, 7 cm wide. Sepals similar, free, linear-lanceolate, attenuate, the dorsal erect, to about 10 cm long, 4-5 mm wide; lateral 8–21 cm long and 5–6 mm wide. **Petals** much shorter than sepals, free, linear-lanceolate, lightly falcate, attenuate, 4-6 cm long, 4-6 mm wide. Lip simple, ovate-lanceolate, acuminate, the margins smooth, 5-6 cm long, 1.2-1.5 cm wide; callus at the base consisting of a pair of white, elevated keels between which is a median, yellow-orange, pubescent furrow. **Column** stout, 7–9 mm long; anther with 2 pollinia, waxy, obpyriform, with viscidium and broad stipe.

Epiphytic, rarely terrestrial on embankments in premontane rain forests at 500–1600 m. Flowering in Costa Rica mostly March to October. Reported from Costa Rica to Peru and Venezuela.

This species is the largest-flowered brassia in Costa Rica. It is most similar to *B. caudata*, which occurs at much lower elevations, and the pseudo-bulbs of that species are apically 2-foliate with rounded edges. We are following authors in recognizing the above synonymy.

Brassia caudata (L.) Lindl., Bot. Reg. 10: t. 832. 1824. Epidendrum caudatum L., Sp. Pl. (ed. 2) 1349. 1763. Malaxis caudata Willd. Sp. Pl. (ed. 4) 4:93. 1805. Oncidium caudatum Rchb. f., Ann. Syst. Bot. 6:766. 1863. Brassia caudata var. hieroglyphica Rchb. f., Ill. Hort. 28:20. 1881. TYPE: "La Perle des Antilles" (w, photo). Figure 28B.

Plant epiphytic, cespitose to 35 cm high. Rhizome short; roots to 2.5 mm in diameter. Pseudobulbs fusiform to oblong, somewhat compressed, 6-10 cm long, 1.5-2.5 cm wide, subtended at the base by foliaceous bracts when young, apically 2-foliate. Leaves elliptic oblong to somewhat oblanceolate, coriaceous, carinate abaxially, 10-20 cm long, 2.5-4.5 cm wide, apex acute. Inflorescence a lateral arcuate raceme of 6-12 distichous flowers, to about 30 cm long including the scape; ovary with pedicel 1-2 cm long. Flowers "spidery" with spreading segments very variable in attenuation, greenish yellow turning orangish with age, marked with maroon; lip white turning yellow with wine red spots. Sepals dissimilar, free, linear-lanceolate, attenuate; dorsal erect and with incurved apex, to 7(12) cm long, 5-8 mm wide; lateral sepals 12-20(33) cm long, 5–7 mm wide. Petals lanceolate, falcate, attenuate, 2.5–5.3 cm long, 3-5 mm wide. Lip simple, oblong lanceolate, acuminate, 3-4.5(5.5) cm long, 1.2-1.5 cm wide; callus of 2 longitudinal, pubescent keels, each terminated by a recurved tooth and between which is a pubescent furrow. Column stout, 3-5 mm long; anther cucullate; pollinia 2, obpyriform, with stipe and viscidium. Capsules 4-5 cm long including the beak, pedicel about 1.5 cm long.

This species grows in tropical lowland rain forests at 0–200 m, where it is usually uncommon though widespread. Flowering in Costa Rica mostly March to July. Reported from Florida, Cuba, and Jamaica and from Mexico and Central America to Bolivia and northern South America.

Brassia caudata is most similar to B. arcuigera Rchb. f., a species that has 1-foliate, sharp-edged pseudobulbs and occurs at higher elevations. Also, the flowers of that species average larger in Costa Rican populations.

Available specimens from the Atlantic drainage have flowers that match very well Linnaeus's concept based on the plate by Plumier. Two herbarium sheets (AMES) based on a plant collected at Pigres on the Pacific Coast by C. Lankester have much larger flowers (lateral sepals 33 cm long) and may represent natural hybrids or a different, perhaps unnamed species.

Brassia gireoudiana Rchb. f. & Warsc., Allg. Gartenzeitung 22:273–274. 1854. TYPE: Warscewicz (not seen). Figure 28C.

Plant a somewhat scandent epiphyte. Rhizome elongate, 3-4 cm between shoots, covered by dark bracts; roots fleshy, to 2.5 mm in diameter. Pseudobulbs elliptic-ovoid, tapering, little compressed laterally, 6-14 cm long, 2.5-4.5 cm wide, subtended by 1 or more foliaceous bracts when young, becoming deciduous with age, apically 2(rarely 1)-foliate, the second leaf borne higher than the first. Leaves petiolate, subcoriaceous, carinate beneath, elliptic-ovate, 20-35 cm long, 2.2-5 cm wide, acute and apiculate apically. Inflorescence a lateral, arcuate raceme of 1-15 flowers neatly arranged on the axis, 75-100 cm long including the scape, borne at the base of the immature to mature shoot; ovary with pedicel 1.8-3 cm long. Flowers large and spectacular, 20-25 cm high, greenish white with brown dots at the base of the sepals, the base of the petals solid dark brown; lip greenish white with brown spots. Sepals similar, free, linear-lanceolate, attenuate to the apex; dorsal erect, 10-13 cm long, 4-5 mm wide; lateral sepals 11-20 cm long, 4-5 mm wide. **Petals** similar to sepals but shorter, 5-10 cm long, 4-5 mm wide, linear-lanceolate, subfalcate. Lip simple rhombic, narrowed at the base forming a narrow claw united to the base of the column, the apex acuminate, the margins lightly crisped, 3.5-7 cm long, 2-3 cm wide; callus at the base fleshy, a pair of keels, somewhat pubescent at the base, rounded and elevated apically. Column stout, 5-6 mm long, somewhat broadened apically; anther with 2 waxy, ovoid, furrowed, pollinia supported on a stipe and viscidium.

Brassia gireoudiana grows in semideciduous to evergreen premontane forests at 500–1000 m at least on the Pacific slope of southern Costa Rica. Flowering February to May. Southern Costa Rica and adjacent Chiriquí, Panama.

This species can be confused with *B. verrucosa* Lindl. but lacks the warts on the lip of that species, and the inflorescence often forms on immature shoots.

Brassia gireoudiana is apparently closely related to Brazilian B. arachnoidea Barb.-Rodr. Both species share nearly identical color patterns in the flowers and a similar rhombic lip. Also, the pseudobulbs are little compressed laterally.

Brassia verrucosa Lindl., Bot. Reg. 26: misc. 36. 1840. Figure 28D.

Plant epiphytic, cespitose, forming small clumps, to about 65 cm tall. Rhizome short; roots to 3 mm in diameter. Pseudobulbs ovoid-conic, furrowed, little compressed laterally, 6-11 cm long, 3.1-4 cm wide, subtended by 1-2 foliaceous bracts, apically 2-foliate. Leaves coriaceous, conduplicate at the base, the apical leaves shortly petiolate, the blade elliptic-lanceolate, acute, 16-30 cm long, 2.6-4.5 cm wide. Inflorescence a lateral, erect, or arcuate raceme of 6-10 flowers in Costa Rican populations, 50-65 cm long including the scape; ovary with pedicel 2.5-3 cm long, subtended by much shorter subulate bracts. Flowers attractive, pleasantly fragrant in Costa Rican populations, to 25 cm high, distichous, yellowish white with bars and spots of reddish brown on the sepals and petals, olive green warts on the lip. Sepals similar, free, linear-lanceolate, attenuate and somewhat canaliculate; dorsal erect, 6.5-13.5 cm long, 6-7 mm wide; lateral sepals 7.5-17.5 cm long, 6-7 mm wide. Petals linear-lanceolate, falcate, attenuate, 4-9 cm long, 6-7 mm wide. Lip obscurely 3-lobate, trullate-subpandurate, broadest just below the middle, acuminate at the apex, verrucose below, 3.5-5.2 cm long, 2.4-3.2 cm wide; callus a pair of keels on the lower ¼, each keel terminated by a tooth. Column erect, 7 mm long; anther with 2 pyriform, sulcate pollinia with stipe and viscidium.

Brassia verrucosa is a species of evergreen to semideciduous cloud forests at 1300–1800 m, where it grows on trunks and larger branches of its host. Flowering December to May. Reported from Mexico to Costa Rica.

Plants observed from northern Nicaragua have smaller and usually more numerous flowers with a rather unpleasant odor compared to those from Costa Rica. Also, Costa Rican plants have fewer warts on the lip than those farther north. We hesitate to repeat the synonymies given by authors because some of them may prove to be different. Although the type of *B. verrucosa* was not determined, a specimen on microfiche, identified by Lindley as the species, was seen.

Cischweinfia Dressler & N. Williams

(D. E. Mora de Retana)

REFERENCE—R. L. Dressler and N. H. Williams, An overlooked genus in the Oncidinae. Amer. Orchid Soc. Bull. 39:988–994, 1970.

Cespitose, usually small epiphytic herbs. Pseudobulbs usually ellipsoid to ovoid, 1-foliate, compressed, subtended by 1 or more foliaceous sheaths. Leaves conduplicate, carinate, elliptic to lanceolate, acute, thin in Costa Rican species. Inflorescence a lateral raceme, shorter than the subtending foliaceous bract in Costa Rican plants, with 1–5 flowers. Flowers spreading, usually attractive. Sepals and petals free, similar. Lip simple, with basal margins usually clasping the column. Column with a pair of auricles beneath the stigma, with distinct hood-shaped and often petaloid anther bed; anther often papillose; pollinia 2 supported on an elongate stipe with viscidium. Fruit a capsule.

A Neotropical genus of about nine species ranging from Costa Rica to South America. There are two species in Costa Rica.

Cischweinfia was described by Dressler and Williams to accommodate species previously classified in the genera Aspasia, Miltonia, and Trichopilia. Chase and Palmer published two cladograms suggesting relationships with Ada, Aspasia, Brassia, and possibly several other genera as well.

Key to the Species of Cischweinfia

1a. Lip surrounding column at base, tepals green suffused with pink; lip white with pink spots C. dasyandra
1b. Lip cuneate, not surrounding the column, tepals brown with yellowish green apex; lip white with yellowish orange at the base. C. pusilla

Cischweinfia dasyandra (Rchb. f.) Dressler & N.Wms., Amer. Orchid Soc. Bull. 39:991. 1970. *Trichopilia dasyandra* Rchb. f., Xen. Orch. 3: 64, t. 230. 1883. TYPE: Costa Rica, *Endres* (w). Figure 29A.

Plant epiphytic, cespitose. Rhizome short, the roots slender, 1–1.5 mm in diameter. **Pseudobulbs** oblong,

compressed, 3–8 cm long, 6–11 mm wide, apically 1-foliate, subtended by 2–3 foliaceous bracts. Leaves linear-lanceolate, conduplicate at the base, acute, keeled abaxially, 9–20 cm long, 7–12 mm wide. **Inflorescence** a short, somewhat pendulous 1–4-flowered raceme borne from the base of the pseudobulb, 4–7 cm long, ovary and pedicel 13–20 mm long. **Flowers** with green sepals and petals suffused with pink, the lip white with pink spots and yellow in the center, 2.4–2.7 cm long and 1.8–2.2 cm wide in natural position. **Sepals** subequal,

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free, elliptic-lanceolate, acute, 1.2–1.4 cm long, 2–3 mm wide; lateral subfalcate and somewhat larger than the dorsal. **Petals** elliptic-oblong, acute, subfalcate, 1–1.2 cm long and 2–3 mm wide. **Lip** with basal margins folded around the column, obovate to suborbicular when spread, emarginate, 1–1.2 cm long and 9–10 mm wide, the margins crenulate; callus basal, glabrous, yellow, with 2 small keels. **Column** 5–7 mm long, erect, semiterete, white, with a prominently dentate to fimbriate anther bed; pollinia 2, orbicular translucent, with narrow stipe and elongate viscidium; stigma bilobed.

Uncommon epiphyte of wet premontane forests at 700–1100(1650) m. Flowering mostly June to September. Costa Rica and Panama; reported also from Colombia and Ecuador.

This species is distinguished from similar *C. pusilla* (C. Schweinf.) Dressler & N. H. Williams by the smaller plants, larger flowers of different color, and overlapping sides of the lip base folded around the column.

Cischweinfia pusilla (C. Schweinf.) Dressler & N. H. Williams, Amer. Orchid Soc. Bull. 39: 992. 1970. Aspasia pusilla C. Schweinf., Bot. Mus. Leafl. 10:21–23, t. 1. 1941. TYPE: Panama, Darien, M. E. & R. A. Terry 1502 (holotype: AMES, photo; isotype: F). Trichopilia pusilla (C. Schweinf.) Garay, Orquideologia 5:20. 1970. Figure 29B.

Plant a cespitose epiphyte sometimes forming large clumps, 20-25 cm high; rhizome short; roots to 1.5 mm in diameter. Pseudobulbs elliptic-ovate, compressed, 1foliate, 3-3.5 cm long, 1-2.1 cm wide, concealed at the base by 2-3 foliaceous bracts. Leaves coriaceous, carinate, with prominent conduplicate petiole; blade ellipticlanceolate, 10-20 cm long, 1-1.5 cm wide, acute. Inflorescence 1–2, lateral at the base of the pseudobulb, about ½ as tall as the plant, 8–10 cm long; lax raceme of 4–5 flowers; ovary with pedicel 2.5–3 cm long, subtended by a triangular, acute bract to 8 mm long. Flowers with brown tepals with lemon yellow apices; lip white with yellow-orange lines at the base. Sepals similar, oblong-elliptic, dorsally carinate, 1.1–1.3 cm long, 3-4 mm wide, the apex acute, apiculate; dorsal erect; lateral sepals subfalcate. Petals similar to the sepals, oblanceolate-elliptic, 9-11 mm long, 3-3.5 mm wide, oblique at the base, the apex acute. Lip cuneate, simple, suborbicular to obovate when spread, 1.1–1.3 cm long, 1-1.2 cm wide, adnate basally to the middle of the column, rounded. Column short, 5 mm long, with a pair of auricles below the stigma; anther bed petaloid, irregularly dentate, forming a hood; anther papillose, triangular in profile; pollinia 2, obovate with elongate stipe and viscidium.

A poorly known and rare epiphyte of tropical humid forests at 600-700 m. Flowering June to

August. Costa Rica and Panama; probably also in Colombia.

Cischweinfia pusilla closely resembles C. dasyandra but differs notably in the cuneate lip, which does not enclose the column, and in flower color.

Comparettia Poeppig & Endl.

(D. E. Mora de Retana)

REFERENCE—I. Bock, Revision der Gattung *Comparettia* Poepp. & Endl. (part 1). Orchidee (Hamburg) 37:193–196. 1986.

Epiphytic, cespitose herb often forming small clumps. Pseudobulbs cylindric, small, often hidden by subtending foliaceous bracts, apex 1-foliate. Leaves subcoriaceous, conduplicate, usually ovate to elliptic, obtuse to acute, petiole essentially none. Inflorescence a laterally borne raceme or panicle, usually with long scape; ovary distinctly pedicellate, subtended by short, triangular bracts. Flowers brightly colored. Sepals dissimilar, the dorsal free, the lateral sepals connate and forming a conspicuous single spur. Petals ovate, usually acute. Lip much longer than the tepals, with a bifid appendage at the base inserted within the sepaline spur, the lamina conspicuously emarginate to 2-lobate. Column stout, usually with broadened stigma; anther with 2 pollinia supported on a slender stipe with viscidium. Fruit a capsule.

A genus of 10–12 vegetatively similar species distributed throughout the neotropics. Only a single species occurs in Costa Rica. The genus is easily recognized by the brilliantly colored, probably bird-pollinated flowers with large, emarginate to 2-lobate lip and conspicuous sepaline spur.

According to Chase and Palmer, *Comparettia* is closely related to *Rodriguezia* and *Scelochilus* but surprisingly not to *Ionopsis*.

Comparettia falcata Poeppig & Endl., Nov. Gen. Sp. 1:42, t. 73. 1836. TYPE: Peru, between Cassapi and Pampayacu, *Poeppig 1646* (not seen). *Comparettia rosea* Lindl., Edwards's Bot. Reg. 26: misc. 78. 1840. TYPE: "Spanish Main," drawing based on *Loddiges 752* (K). Figure 29C.

Plant epiphytic, cespitose, forming small clumps. Rhizome short, the roots stout, much branched, 1–1.5 mm in diameter. **Pseudobulbs** cylindric, 1-foliate, 1.5–2.5 cm long, 7–10 mm broad, green suffused with purple, subtended by papery bracts. **Leaves** variable, elliptic, coriaceous to somewhat fleshy, the apex rounded and apiculate or bluntly acute, 5.5–19 cm long, 1.5–5.5 cm

wide. Inflorescence lateral, 15-55 cm long including the scape and panicle, rarely subtended by a foliaceous bract; ovary and pedicel about 1.5-2 cm long. Flowers purplish red or pink with white centrally, 2-2.3 cm high and 1.5-0.7 cm wide in natural position. Sepals dissimilar; the dorsal free, elliptic-lanceolate, acuminate, 10-12 mm long and 4-6 mm wide; lateral connate for their entire length, forming a spur at the base, 2.2-2.4 cm long including the spur, 5-6 mm wide. Petals free, obovate, the apex rounded, apiculate, 11-12 mm long, 5-7 mm wide. Lip obscurely 3-lobulate, 1.3-1.5 cm long and 1.4-1.6 cm wide, the lateral lobes small, subtriangular; midlobe reniform, deeply emarginate, contracted at the base, forming a claw united by its margins and central keel to the column and extending at the base into 2 filiform appendages; disk glabrous and somewhat fleshy with a white callus. Column stout, 4-5 mm long, broadened above, with a pair of wings near the apex; anther with 1 cell; pollinia 2, waxy, with conspicuous stipe and viscidium; stigma entire, somewhat bilobed. Capsules variable depending on plant size, 2–5 cm long including the conspicuous beak, with pedicel 0.8-1.7 cm.

Epiphytic on small branches and trunks in open canopies of premontane and lower montane forests at 800–2000 m. *Comparettia falcata* is one of few orchids that colonize twigs of guava trees. Flowering mostly May to August, September to November, and probably sporadically throughout the year. Widespread throughout the neotropics.

Comparettia falcata is easily identified by the pink to red or purple flower with proportionately large, 2-lobate lip and conspicuous spur.

Fernandezia Ruiz & Pav.

(D. E. Mora de Retana)

Plant a monopodial epiphyte. Stems erect, creeping or pendulous, concealed by leaf sheaths; pseudobulbs lacking. Leaves conduplicate, distichous, articulate, chartaceous, coriaceous, to fleshy, usually elliptic to oblong. Inflorescence lateral, short, a few-flowered raceme. Flowers showy, red to yellow, orange, or purple, never green, spreading to campanulate. Sepals similar, the laterals sometimes partially connate. Petals usually larger than the sepals. Lip usually simple, often flabellate, sometimes the base parallel with the column and the apex somewhat reflexed, callus present and usually very different between species. Column simple, often with broad, dentate wings apically; anther with 2 pollinia with elongate, simple, or furcate stipe, or each with separate stipe; viscidium elongate. Fruit a capsule.

A high-elevation genus of perhaps 12 species. Only a single species is known from Central America.

Fernandezia is probably most closely related to Pachyphyllum, which has an identical growth habit but much smaller, greenish to whitish flow-

ers. Dressler (1993) notes the similarity of growth habits and pollinia to *Lockhartia* and *Raycadenco* and places both *Fernandezia* and *Pachyphyllum* in the Oncidinae.

Fernandezia tica Mora-Retana & J. B. García, Brenesia 39–40:163–165. 1993. TYPE: Costa Rica, Heredia, road to Vara Blanca, 2000 m, 27 Oct. 1992, J. T. Atwood & O. Rodríguez 4181 (holotype: USJ). Figure 29D.

Plant epiphytic, monopodial, small, to about 8 cm long. Stems somewhat creeping; roots to 2 mm in diameter. Leaves fleshy, green, purplish and keeled beneath, elliptic, ca. 20 mm long, 8 mm wide; forming a prominent sheath at the base ca. 5 mm long; apex acute. Inflorescence lateral, short, of 2–3 flowers; ovary with pedicel prominently winged, ca. 13 mm long. Flowers fleshy campanulate, red-purple, ca. 8 mm long. Sepals subequal, shortly connate at the base, ovate-elliptic, prominently keeled abaxially, 10 mm long, 6 mm wide, acute; dorsal erect; lateral sepals subfalcate. Petals elliptic-ovate, 8 mm long, 6 mm wide, the apex recurved. Lip simple, elliptic-ovate to somewhat trulliform, 8 mm long, 4 mm wide, somewhat recurved near the middle, forming a cavity at the base; callus on the lower 3/3 of 2 slender prominent keels ending in a fleshy transverse ridge and bifurcating above. Column robust, 7 mm long, with prominent wings above; anther about 1.5 mm in diameter; pollinia 2, elliptic-ovate supported on separate stipes and connected to a prominent elongate viscidium. Capsule unknown.

Very poorly known epiphyte at 2000 m, where the type was found growing in strong winds and frequent cloud cover but occasionally exposed to nearly full sun. Flowering in late October but to be expected at other times of the year. Apparently endemic to Costa Rica.

The existence of a fernandezia in Costa Rica has been known for some time, but few specimens had been collected until recently. No other plants were observed growing near the holotype, and the plant is apparently rare.

Goniochilus M. W. Chase

(D. E. Mora de Retana)

REFERENCE—M. W. Chase, Revisions of *Hybochilus* and *Goniochilus* (Orchidaceae). Contr. Univ. Michigan Herb. 16:109–127. 1987.

Plant a cespitose **herb** epiphytic on twigs. **Pseudo-bulbs** ovoid to suborbicular, ancipitous; base concealed by 2–3 foliaceous bracts; apex 1-foliate. **Leaves** coriaceous, elliptic-lanceolate, shortly petiolate at the base,

the apex acute. Inflorescence lateral at the base of the pseudobulb, a raceme in small plants, paniculate when large. Flowers small, colors weakly attractive. Sepals dissimilar, carinate, acuminate, the laterals united to ½ their length. Petals simple, oblong-elliptic, obtuse. Lip 3-lobate, the midlobe emarginate; callus simple. Column stout, the base forming a short nectary with the lip; apex with a pair of auricles; anther more or less dorsal; pollinia 2. Fruit a capsule.

A monotypic genus differing from closely related *Leochilus* by the conspicuously 3-lobate lip and the column, which is somewhat bent upward. The close apparent relationship with *Leochilus* is supported by evidence from DNA by Chase and Palmer.

Goniochilus leochilinus (Rchb. f.) M. W. Chase, Contr. Univ. Mich. Herb. 16:125. 1987. Rodriguezia leochilina Rchb. f., Gard. Chron. 1:970. 1871. TYPE: Costa Rica. Mesospinidium leochilinum (Rchb. f.) Schltr., Repert. Spec. Nov. Regni Veg. 19:253. 1923. Figure 30A.

Plant cespitose, epiphytic, somewhat reddish 6-15 cm tall excluding the inflorescence. Rhizome short, roots slender, to 1(1.5) mm in diameter. Pseudobulbs 1-foliate, ellipsoid-ovoid to suborbicular, ancipitous, (0.6)1.5– 2 cm long, 1.3–1.7 cm wide, covered when young by foliaceous bracts deciduous with age. Leaves conduplicate, petiolate, the blade elliptic-lanceolate, carinate abaxially, acute, (2.5)6-14 cm long, (0.6)1.3-2.4 cm wide, the apex asymmetric. Inflorescences 1-2, lateral, pendulous, 10-32 cm long including the scape, with few to many flowers; ovary and pedicel 3-6 mm long, subtended by a triangular, acute bract 2-4 mm long. Flowers 1 cm high and 5 mm wide; sepals and petals greenish yellow with red-brown spots, the lip white with reddish spots. Sepals subequal, strongly concave, carinate, the dorsal ovate, 6-9 mm long, 3-5 mm wide; lateral sepals fused for about \(\frac{1}{2} \) their length, each 6-9 mm long, 2-3 mm wide. Petals ovate-elliptic, 5-7 mm long, about 3 mm wide. Lip 3-lobate, 9-11 mm long, 4 mm wide; lateral lobes semicircular to triangular; midlobe subquadrate, convex, emarginate, the apical ½ forming an obtuse angle with the base; callus on the lower 3/3 a simple sulcate pad, higher toward the base. Column 4-7 mm long; anther globose; pollinia 2, ovoid, with broad triangular stipe and prominent elliptic viscidium. Capsules ellipsoid, with 3 conspicuous ribs, 1.5–2.5(4.5) cm long including the beak; pedicel 4-5 mm long.

Goniochilus leochilinus grows on twigs and slender branches of trees, often in abandoned coffee, citrus, and guava plantations in premontane and lower montane rain forests at 600–1600 m. Plants are common but little collected. Flowering September to January. Reported from Nicaragua to Panama.

This species can be confused with species of

Leochilus, but the lip is clearly 3-lobate and the column somewhat bent upward, putting the anther in a dorsal position.

Hybochilus Schltr.

(D. E. Mora de Retana)

REFERENCE—M. W. Chase, Revisions of *Hybochilus* and *Goniochilus* (Orchidaceae). Contr. Univ. Michigan Herb. 16:109–127. 1987.

Cespitose epiphytic **herb** of twigs and small branches. **Pseudobulbs** ovoid to suborbicular, subtended by 2–3 foliaceous sheaths; apex 1(2)-foliate. **Leaves** coriaceous, conduplicate, elliptic-lanceolate, the apex unequally 2-lobate. **Inflorescences** 1–2 per shoot, lateral, pendent paniculate. **Flowers** minute, campanulate with rather dull colors. **Sepals** dissimilar, the lateral to ³4 united; **petals** free, connivent with the sepals; **lip** simple or obscurely 3-lobate, forming a nectary at the base with the column, subquadrate, retuse; **column** stout, anther terminal.

A monotypic genus endemic to Costa Rica and possibly western Panama.

According to Chase, *Hybochilus* is closely related to both *Leochilus* and to *Goniochilus*. It is easily distinguished from both by the much smaller, campanulate flowers borne in dense panicles.

Hybochilus inconspicuus (Kraenzl.) Schltr., Repert. Spec. Nov. Regni Veg. 16:430. 1920. Rodriguezia inconspicua Kraenzl. Bull. Herb. Boissier 3:630. 1895. Rodriguezia candelariae Kraenzl. Bot. Jahrb. Syst. 54, Beibl. 117:32. 1916. Leochilus parviflorus Standley & L. O. Williams, Ceiba 1:235. 1951.

Plant a cespitose epiphyte 2-11 cm tall. Pseudobulbs suborbicular to elliptic-ovoid, rugose when old, 1-2.5 cm long, 0.5-2 cm wide, subtended by 1-2 foliaceous bracts, apex 1-foliate. Leaves coriaceous, carinate, elliptic to lanceolate, 1.5-7.5 cm long, 0.6-2.5 cm wide, sometimes shortly petiolate, apex unequally 2-lobate. Inflorescences 1-2 per shoot, paniculate, lateral, pendent, many-flowered, 6-20 cm tall; ovary with pedicel 2-4 mm long, subtended by shorter, triangular, acute bracts. Flowers minute, inconspicuous, rather closed, sepals greenish with purplish margins, petals whitish with purplish margins, lip white with pale purple spots. Sepals dissimilar, the dorsal free, laterals to \(\frac{3}{4} \) connate, ovate, 2.5-3 mm long, 1.5-2 mm wide. Petals ovate, 2.5-3 mm long, 2 mm wide, obtuse. Lip simple or obscurely 3-lobate, 3.5-5 mm long, 1.5-2 mm wide, the apex emarginate; callus an elongate, 2-lobate pad. Column stout, 0.5-1 mm long, about 1 mm in diameter, the apex with a pair of extrorse stigmatic arms, forming a nectary at the base with the lip. Capsules $0.8-1(1.5)~\mathrm{mm}$ long including pedicel and beak.

Rather common twig epiphytes in evergreen and often disturbed cloud forests at 950–1500 m; often seen in coffee plantations. Flowering (January) February to May (June). Costa Rica, especially in the Central Valley; also reported from Panama.

This species is easily recognized by the minute flowers on plants resembling *Leochilus*. The above synonomy and floral measurements are taken from Chase's revision.

Ionopsis H. B. K.

(D. E. Mora de Retana)

Epiphytic herb usually on twigs; rhizomes short to much elongate, with at most rudimentary pseudobulbs. Leaves lateral, rarely at the pseudobulb apex, terete or flat, conduplicate and somewhat fleshy. Inflorescence lateral, slender, erect or arcuate, a simple raceme or panicle, with elongate scape. Flowers usually small. Sepals and petals subequal, the lateral sepals connate at the base producing a short sac; lip clawed and adnate to the column base, much exceeding the tepals, 2-lobate. Column footless, lacking wings; pollinia 2, waxy, supported on viscidium and elongate stipe. Fruit a capsule.

A mostly lowland genus of three species ranging throughout the neotropics.

Key to the Species of Ionopsis

1a.	Leaves terete	 	 	I. satyrioides
1b.	Leaves flat	 	 	I. utricularioides

Ionopsis satyrioides (Sw.) Rchb. f., Ann. Bot. Syst. 6:683. 1863. Epidendrum satyrioides Sw., Prod. 123. 1788. TYPE: Hispaniola. Ionopsis costaricensis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:62. 1923. TYPE: Costa Rica, Wercklé 25 (not seen).

Plant a cespitose epiphyte of twigs and smaller branches; roots fibrous, to 0.5 mm in diameter. Pseudobulb nearly obsolete and often hidden by subtending leaves. Leaves 3-6, terete, acute, 2.5-13 cm long, to 3-4 mm in diameter. **Inflorescence** a lateral successively flowered raceme 6-19 cm long including the scape; ovary with pedicel 8-10 mm long, subtended by much shorter subulate bracts. Flowers white or with fine purple lines, with yellow callus. Sepals somewhat campanulate, shortly connate at the base and not widely spreading, lanceolate-elliptic, acute, 5-6 mm long, 1.5-2 mm wide, the lateral forming a short mentum. Petals oblanceolate to elliptic, obtuse, recurved, 5.5-6.5 mm long, 1.5-2 mm wide. Lip cuneate, lightly emarginate, 7.5-8 mm long, 2.5-3, with a pair of mammillate calli at the base. Column stout, 1.5-2 mm long. Capsule obovoid, about 1 cm long.

Epiphytic and common in disturbed moist forest at 0–750 m. Flowering August to October. Reported throughout Mesoamerica, West Indies, and South America. *Ionopsis satyrioides* is easily recognized by the terete leaves and small, whitish flowers with large, emarginate lip. There is some suggestion that there may be more than one species here accepted as one.

Ionopsis utricularioides (Sw.) Lindl., Coll. Bot. t. 39A. 1821. *Epidendrum utricularioides* Sw., Prodr. 122. 1788. Figure 30B.

Plant an epiphyte, usually of twigs and smaller branches, usually with only 1-2 shoots, to 15 cm high; roots fibrous, 0.5-1 mm in diameter. Pseudobulbs short, 6-10 mm tall, 4-5 mm wide, concealed by the subtending 2-4 foliaceous sheaths. Leaves distichous, somewhat fleshy, with conspicuous raised veins adaxially, variable in shape from elliptic to oblong or oblanceolate, acute, 4-15 cm long, 0.6-2 cm wide. Inflorescence a somewhat successively flowered panicle borne laterally near the pseudobulb base, to 50 cm high including the peduncle; ovary with pedicel 5-10 mm long. Flowers white or pink, veined with magenta. Sepals dissimilar; dorsal ovate, acute to obtuse, 3.5-4.5 mm long, 1.8-2.3 mm wide; lateral sepals shortly connate, acute, 4.5-5.5 mm long, 1.4-2 mm wide, forming a short mentum at the base. Petals ovate, 3.5-5 mm long, 1.8-2.5 mm wide. Lip shortly clawed at the base, flabellate-obovate and deeply emarginate, 10-12 mm long, 7-10 mm wide, with 3 purple lines at the base, and a pair of white calli. Column cylindric, stout, 2 mm long; anther with cucullate, somewhat beaked anther, pollinia 2 supported on an elongate stipe and elongate viscidium. Capsules ellipsoid, without beak, about 2.5 cm long; pedicel 7-8 mm long.

Epiphytic on twigs and smaller branches of usually disturbed evergreen forests, often seen in coffee and guava at 0–880 m. Flowering mostly January to May (August). Widespread and locally common throughout the wetter lowland neotropics.

Ionopsis utricularioides is easily recognized by

the flat, somewhat fleshy leaves, the pseudobulb, which usually lacks an apical leaf, and the panicles of the pinkish flowers with a large, emarginate lip.

Leochilus Knowles & Westcott

(D. E. Mora de Retana)

REFERENCES—M. W. Chase, A Monograph of *Leochilus* (Orchidaceae). Systematic Botany Monographs 14. 97 pp. 1986. M. W. Chase, Pollination ecology of two sympatric, synchronously flowering species of *Leochilus* in Costa Rica. Lindleyana 1:141–147. 1986.

Small cespitose **herb**, epiphytic, often on twigs and smaller branches. **Pseudobulbs** elliptic-ovoid to subor-

bicular, compressed, 1–2-foliate, subtended by 2–3 leaves, the apex 1–2-foliate. Leaves coriaceous, conduplicate, elliptic to lanceolate, acute to obtuse. Inflorescence an erect or pendent lateral raceme or panicle with slender peduncles and 1–many successively borne flowers. Flowers small, colors generally dull. Sepals spreading, the laterals free or variously connate, adnate to lip base. Petals similar to the sepals, free. Lip adnate to column base forming a nectary, longer than the sepals and petals, simple or lightly 2-lobate, with a fleshy callus near the base. Column footless, short, with arms on each side at about the middle; pollinia 2, waxy. Fruit a capsule

A Neotropical genus of about nine species centered mainly in Mesoamerica and the Caribbean; also in northern and western South America. Three species are known in Costa Rica.

The relationships of *Leochilus* are clearly with *Goniochilus* and *Hybochilus*, and possibly with other genera of mostly twig epiphytes. For synonymies see the revision of *Leochilus* by Chase.

Key to the species of *Leochilus* (including *Hybochilus* and *Goniochilus*)

1a. Sepals ≥ 3.5 mm long	2
2a. Lip simple, whitish to yellow often with dull spots	3
3a. Plants clearly reddish Leochilus labiat	us
3b. Plants clearly green	4
4a. Pseudobulbs prominent, ovoid, usually > 2 cm long, low-elevation plants	
Leochilus script	us
4b. Pseudobulbs mostly hidden by foliaceous bracts, < 1.9 cm tall, plants mid to high	gh
elevation Leochilus tricuspidat	us
2b. Lip 3-lobate, white with dark spots Goniochilus leochilin	us
1b. Sepals ≤ 3.25 mm long Hybochilus inconspicu	us

Leochilus labiatus (Sw.) Kuntze, Revis. gen. pl. 2:656. 1891. *Epidendrum labiatum* Sw., Nov. gen. & sp. pl., Prodr. 124. 1788. Figure 30C.

Plant a small cespitose twig epiphyte 2–5 cm tall excluding inflorescence; roots long, to about 1 mm in diameter. Pseudobulbs compressed, orbicular to ovate, 1-1.8 cm tall, with 1-2 leaves at the base, apex 1-foliate. Leaves coriaceous, elliptic to lanceolate, acute, 2-4.5 cm long and 1-1.5 cm wide. Inflorescence a raceme or panicle with 1-2 branches, lateral at the pseudobulb base, successively flowered, 2-12 cm long including the peduncle; ovary with pedicel about 6-9 mm long. Flowers with sepals and petals yellowish green marked with red-brown and with a yellow lip marked with red-brown. Sepals dissimilar, the dorsal sepal ovate, acute, cucullate, 5-6.5 mm long, 2.5 mm wide; the lateral sepals free to ½ united, about 5-6 mm long. Petals ovate-elliptic, about 4-5 mm long. Lip obovate, emarginate, about 7-8 mm long and 3-4 mm wide, provided with a shallow basal nectary and a central fleshy callus most prominent below the middle. Column about 2.5 mm

long, with a pair of oblong arms at about the middle; anther with 2 pollinia supported on an elongate stipe and viscidium. **Capsules** ellipsoid, weakly 3-carinate, 2.5 cm long including the prominent beak; pedicel 8–10 mm long.

Common twig epiphytes, of evergreen forests at 50–2000 m. It is often weedy in coffee plantations, citrus groves, and guava. Flowering mostly October to April. For distribution Chase includes the West Indies, Mesoamerica, and northern South America.

Leochilus labiatus is easily distinguished from the other species by the reddish plants, suborbicular pseudobulbs, and greenish yellow flowers with red-brown markings. Chase did not encounter specimens below 500 m in Costa Rica, but a specimen at SEL collected at less than 100 m (Atwood 85–72) appears to be this species.

Leochilus scriptus (Scheidw.) Rchb. f., Xenia Orchid. 1:15. 1854. *Cryptosanus scriptus* Scheidweiler, Allg. Gartenzeitung 11:101. 1843.

Plant a cespitose epiphyte 8–15 cm high; rhizomes short, roots to 1.5 mm in diameter. Pseudobulbs ovoid, not strongly compressed, grooved, 2-5 cm long, 1-2.5 cm wide, subtended by 1-2 foliaceous sheaths, apex 1foliate. Leaves somewhat petiolate, the blade ellipticlanceolate, 4-12 cm long, 1-3 cm wide, apex acute. Inflorescences 1-2, 4-15(29) cm long, each a raceme or panicle; ovary with pedicel about 1 cm long, subtended by shorter, triangular bracts. Flowers fragrant, 1-6, tepals greenish yellow with reddish spots, lip yellow to yellowish green with red to rose spots. Sepals oblonglanceolate, dissimilar, acute, 7-12 mm long, 3-5 mm wide; dorsal free; lateral sepals to ½ connate. Petals ovate, acute, 7-10(15) mm long, 5-7 mm wide. Lip obovate, emarginate, 6-12(14) mm long, 5-9 mm wide, forming a rounded nectary at the base with the column. Column 6-8 mm long, pollinia 2 on an elongate stipe with viscidium. Capsules 3-4 cm long including the long beak; pedicel 1-1.2 cm long.

Leochilus scriptus grows in moist to semideciduous forests at 0-600(1100) m. Flowering in Costa Rica mostly December to April. Reported from Mesoamerica to coastal tropical South America, Cuba, and the Dominican Republic.

This species is easily distinguished from others principally by its lower-elevation distribution and in its large pseudobulbs. The flowers otherwise resemble those of the other species.

The above measurements incorporate those published by Chase in his revision of *Leochilus*.

Leochilus tricuspidatus (Rchb. f.) Kraenzl., Pflanzenr. IV. 50(Heft 80):297. 1922. *Oncidium tricuspidatum* Rchb. f., Beitr. Orch.-K.C.Amer. 72. 1866. Figure 30D.

Plant epiphytic, cespitose, 8–12 cm high excluding inflorescence. Rhizome short; roots 1–1.5 mm in diameter. Pseudobulbs ovate to lanceolate, 1(2)-foliate, compressed, 1–1.8 cm long, 4–6 mm wide. Leaves subcoriaceous, elliptic-lanceolate, apically asymmetric, 5–9.5 cm long, 0.9–2 cm wide. Inflorescences paniculate, 1–2 from the base of the pseudobulb, 8–35 cm high, with 5–15 flowers, lightly fractiflex, the scapes covered by triangular, papery bracts; ovary with pedicel 5–11 mm long. Flowers opening successively, greenish yellow with brown spots, the lateral sepals with the spots coalescing into a central line, 1.4–1.6 cm long and 9–11

mm broad. **Sepals** free, subequal; dorsal sepal elliptic-lanceolate, concave, obtuse; lateral sepals elliptic-lanceolate, subfalcate, acute, carinate, 5–8 mm long, 3–4 mm wide. **Petals** free, elliptic, obtuse, concave, 4–7 mm long, 3–4 mm wide. **Lip** simple, oblanceolate, obtuse, pubescent, with a small nectary at the base, 5–12 mm long, 2.5–5 mm wide; blade with 2 erect projections at the base and an erect callus with numerous small hairs, the apex emarginate. **Column** semiterete, 4–8 mm long, the apex denticulate, with 2 fleshy auricles beside the stigma; pollinia 2, with elongate stipe and viscidium. **Capsule** ellipsoid, strongly 3-carinate, 2–3 cm long, pedicel 1–1.2 cm long.

This species is a twig epiphyte of evergreen forests at 1200–2000 m. Flowering mostly February to June and sporadically to October. Endemic to Costa Rica and adjacent Chiriquí, Panama.

Leochilus tricuspidatus is easily distinguished by the small pseudobulbs hidden by subtending foliaceous bracts.

Lockhartia Hook.

(D. E. Mora de Retana)

REFERENCE—M. W. Chase, A reappraisal of the Oncidioid orchids. Syst. Bot. 11:477–491. 1986.

Epiphytic, cespitose, psygmoid herb, stems unbranched above. Pseudobulbs none. Leaves congested and sheathing the stem, imbricate, remaining conduplicate, inarticulate, usually triangular in profile. Inflorescences 1–several racemes, lateral, of 1–several flowers. Flowers usually attractive, usually yellow with red marking or white, complex, especially the callus of the lip. Sepals simple, ovate, free, concave, reflexed. Petals simple, ovate. Lip simple to complexly lobed, the callus often complex. Column short, usually winged, lacking a tabula infrastigmatica; pollinia 2, usually obovate to clavate, with stipe and small viscidium. Fruit a capsule.

An odd genus of 20–25 species native from Mexico to South America but noticeably absent from the Antilles. Six species are known from Costa Rica.

The relationships of *Lockhartia* are unclear, but they probably belong within the Oncidiinae. The flowers superficially resemble those of *Oncidium* but lack the tabula infrastigmatica. Plant habit is similar to that of *Psygmorchis* Dodson & Dressler but has a longer stem.

Key to the Species of Lockhartia

1a. Lateral lobes present at the base of the lip
2a. Flowers < 1 cm tall
2b. Flowers > 1 cm tall
3a. Lip apex less than twice as broad as base of midlobe; floral bracts 6–10 mm wide
L. amoena
3b. Lip apex at least twice as broad as base of midlobe; floral bracts < 6 mm wide
L. oerstedii
1b. Lateral lobes absent at the base of the lip, lip entire, 2-lobate or with lateral lobes near the middle
4a. Flowers white, lip suborbicular, callus orange, leaves slender and flexible L. hercodonta
4b. Flowers yellow, lip longer than wide; leaves stiff 5
5a. Flowers at least 1.2 cm tall, inflorescence compact with inconspicuous branches
L. pittieri
5b. Flowers ≤ 1 cm tall; inflorescence spreading and diffuse, the branches conspicuous
L. acuta

Lockhartia acuta (Lindl.) Rchb. f., Bot. Zeitung (Berlin) 10:767. 1852. Fernandezia acuta Lindl., Edwards's Bot. Reg. 21: t. 1806. 1836. TYPE: Trinidad. Lockhartia pallida Rchb. f., Bonplandia 2:14. 1854. TYPE: Venezuela, Carabobo, Wagener (W, photo). Figure 32A.

Plant epiphytic, cespitose, to 40 cm; roots slender, 0.5-1 mm in diameter. Stems arcuate or pendulous, laterally flattened, leafy, 25-40 cm long. Leaves distichous, densely imbricate, somewhat fleshy, triangular in profile, acute, 2-3.5 cm long, 3-9 mm deep. Inflorescence terminal or lateral near the apex, diffusely branched, with few flowers opening in succession; ovary and pedicel ca. 9 mm long, subtended by cordate bracts 1-2 mm long and 1-2 mm wide. Flowers cream-white, small for the genus, 5-9 mm tall, 7-8 mm wide. Sepals similar, rounded or obtuse, free, concave, 2-3 mm long, 2-3 mm wide. Petals similar to the sepals in form and size. Lip simple to obscurely 3-lobate, subquadrate, with reddish brown marks on the basal half, 5-6 mm long, 3-4 mm wide, the apex retuse and with somewhat irregular lateral margins; lower ½ with a pale, papillose callus, the apex with 2 rounded projections. Column white with reddish brown spots at the base, with rounded wings, the margins smooth, 1-2 mm high, 2-3 mm wide; anther papillose; pollinia 2, pyriform with relatively large stipe and viscidium.

Epiphytic in seasonally moist forests of the Pacific drainage at 50–600 m. Flowering December to March. Known from Costa Rica to Colombia, Venezuela, Trinidad, and Tobago.

Lockhartia acuta is similar to L. micrantha Rchb. f. but may be distinguished by the much larger, usually pendulous stems and by the more diffuse, branching inflorescence. Costa Rican examples lack the extreme acute lateral lobes of the lip found in the type from Trinidad.

Lockhartia amoena Endres & Rchb. f., Gard. Chron. 666. 1872. TYPE: Costa Rica. Endres (w. photo), Lockhartia costaricensis Schltr., Repert. Spec. Nov. Regni Veg. 3:81-82. 1906. TYPE: Costa Rica, Los Palmares, Pittier 10592 (AMES). Lockhartia dipleura Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:69. 1923. TYPE: Costa Rica, Wercklé 102. Lockhartia grandibractea Kraenzl., Pflanzenr. IV. 50 (Heft 83):15. 1923. TYPE: Costa Rica, Endres (w, photo). Lockhartia triangulabia Ames & C. Schweinf., Sched. Orch. 8:80-81. 1924. TYPE: Panama, Province of Chiriquí, Powell 362a (AMES). Lockhartia amoena var. triangulabia (Ames & C. Schweinf.) C. Schweinf. & P. H. Allen, Bot. Mus. Leafl. 13:150. 1948. Figure 31A.

Plant epiphytic, cespitose, to 40 cm tall. Roots slender, 0.5–1 mm in diameter. Stems erect, pendulous when large, flattened. Leaves distichous, somewhat fleshy, triangular in profile, acute, 1.3-3.5 cm long, 5-10 mm deep. Inflorescence branched, terminal or lateral near the apex, few- to many-flowered; ovary with pedicel 15 mm long, subtended by cordate, suborbicular bracts 4-10 mm long and 6-10 mm wide. Flowers deep yellow with reddish brown spots, of medium size for the genus, 1.3-1.9 cm long, 1.6-1.7 cm wide. Sepals similar, free, ovate, apiculate, 5-7 mm long, 4-6 mm wide, the dorsal lightly reflexed, the lateral strongly reflexed. Petals similar, free, somewhat larger than the sepals, oblong to elliptic, with undulate margins, 7-8 mm long, 4-5 mm wide, obtuse. Lip 3-lobate, 5-9 mm long, 6-8 mm wide; the lateral lobes linear, obtuse, incurved, 5-7 mm long, 1-3 mm wide; midlobe subquadrate, emarginate, with the base more than 1/2 the width of the apex; disk with callus of papillae from the base to ca. 34 the lip, emarginate in front. column broadly winged, 2-3 mm high,

5–6 mm wide, the margins denticulate; anther papillose; pollinia 2, pyriform; stipe and viscidium small.

Lockhartia amoena grows on larger branches and tree trunks in premontane forests at 800–1400 m. Flowering throughout the year. Reported from Mexico to Colombia.

Lockhartia amoena, as here interpreted, is a most variable species, especially in the size of the inflorescences, number of flowers, and midlobe of the lip. Lockhartia dipleura Schltr. is based on a plant with a nearly entire, not emarginate, midlobe, but we find intermediates between plants with entire and plants with deeply emarginate lips, and both extreme forms have the same linear lateral lobes and similar calli.

Lockhartia hercodonta Rchb. f. ex Kraenzl., Pflanzenr. IV. 50(Heft 83):8, t. 2A. 1923. TYPE: Costa Rica, *Endres* (w, photo). Figure 31B.

Plant cespitose, epiphytic, 10–45 cm high. Rhizome short, with slender roots < 1 mm in diameter. Stems erect or pendulous, compressed, foliaceous. Leaves triangular in profile, thin and flexible, imbricate, 2.8-4.3 cm long, lateral width 5-10 mm deep; apex usually incurved, acute to somewhat acuminate. Inflorescence apparently terminal or subterminal, usually branched, successively flowered; ovary and pedicel 5-6 mm long, subtended by variable, ovate-lanceolate, acuminate bracts 5-7 mm long. Flowers small, 8-10 mm in diameter, white, the lip with orange callus. Sepals concave, ovate, acute, 3-4 mm long, 2-3 mm wide. Petals lightly rounded, concave, 4–5 mm long, 3–4 mm wide. Lip simple, suborbicular, 4–5 mm long, 6–7 mm wide; with an elevated, cuplike, papillose, apically bidentate callus. Column short, broad, 2-3 mm long, with crenulate wings on the upper ½; pollinia 2 with stipe and minute viscidium. Capsule globose to ellipsoid, 8 mm long, with pedicel ca. 5 cm long.

This species grows in premontane and lower montane rain forests at 900–2000 m, usually in deep shade. Flowering August to March and sporadically in June and July. Reported from Guatemala to Panama and Colombia.

Lockhartia hercodonta is easily distinguished from others, especially the cream-white-flowered L. acuta (Lindl.) Rchb. f., by the soft, thin leaves, suborbicular lip, and orange callus. Vegetatively it is similar to L. pittieri Schltr., a low-elevation species with yellow flowers.

Lockhartia micrantha Rchb. f., Bot. Zeitung (Berlin) 10:768. 1852. TYPE: Panama(?), Veragua, *Hinds* (w, photo). *Lockhartia chiriquensis*

Schltr., Repert. Spec. Nov. Regni Veg. 12:215. 1913. TYPE: Panama, Chiriquí near San Felix, *Pittier* (AMES, drawing). *Lockhartia lankesteri* Ames, Sched. Orch. 5:36. 1923. TYPE: Costa Rica, San Carlos, *Lankester 448* (holotype: AMES). Figure 31C.

Plant epiphytic, cespitose, compact, 12–30 cm high. Roots slender, 0.5-1 mm in diameter. Stems erect or pendulous, laterally flattened, densely foliaceous. Leaves distichous, densely imbricate, triangular in profile, somewhat fleshy, acute, 0.8-2 cm long, 5-8 mm wide. Inflorescence short, terminal or lateral near the apex, of few flowers; ovary with pedicel 8-9 mm long, subtended by cordate, acuminate bracts, ca. 6 mm long. Flowers small for the genus, 7-9 mm long and about as wide, clear or pale yellow, column pale yellow with small reddish brown spots at base, callus with small, brown spots. Sepals concave, similar, ovate, apiculate, free, 5-6 mm long, 4-5 mm wide. Petals elliptic, 5-6 mm long, 2-3 mm wide; margins lightly undulate. Lip 3-lobate, 5-6 mm long, 6-7 mm wide; lateral lobes linear, ascending, obtuse; midlobe, cuneate, emarginate with a small notch on each side; callus suborbicular, verrucose, broad at the base, narrow at the apex. Column 2 mm long with broad wings; anther cucullate, papillose; pollinia 2, pyriform, with relatively large stipe. Capsules obovoid to ellipsoid, 6-8 mm long, pedicel ca. 1-1.2 cm long.

This species generally grows in humid open forests at 10–900 m in bright light. Flowering November to April. Broadly distributed from Nicaragua to Panama; also reported from northwestern South America.

Lockhartia micrantha is characterized by the small, pale yellow flowers and linear lobes at the base of the lip.

Lockhartia oerstedii Rchb. f., Bot. Zeitung (Berlin) 10:767–768. 1852. TYPE: Costa Rica, Barba, Oersted s.n. (K, photo seen). L. verrucosa Lindl. ex Rchb. f., Hamburger Garten-Blumenzeitung 15:53–54. 1859. TYPE: Stange? (K, photo). Lockhartia lamellosa Rchb. f. Hamburger Garten-Blumenzeitung 21:300. 1865. TYPE: Mexico, Stange. Fernandezia robusta Bateman, Bot. Mag. t. 5592. 1866. TYPE: Guatemala, Skinner s.n. Lockhartia robusta (Bateman) Schltr., Repert. Spec. Nov. Regni Veg. 3: 82. 1906. Figure 31D.

Plant epiphytic, cespitose, sometimes densely so. Roots slender, 0.5–1 mm in diameter. Stems erect or arcuate, (12)25–40 cm long. Leaves distichous, imbricate, triangular in profile, somewhat fleshy, acute, about 1–3 cm long, 4–8 mm deep. Inflorescence of few successively borne flowers, terminal or lateral near the stem apex; ovary with pedicel 1–1.5 cm long, subtended by

cordate bracts about 5 mm long, 4 mm wide. Flowers bright yellow with reddish brown spots, rather large for the genus, 2-2.5 cm high and 1-1.5 cm wide. Sepals similar, free, elliptic, obtuse, reflexed, 5-9 mm long, 6-7 mm wide. **Petals** ovate, larger than the sepals, the margins undulate, 8-11 mm long, 5-7 mm wide. Lip 3lobate, the margins undulate, 1.3-1.6 cm long, 1.2-1.5 cm wide; basal lateral lobes spatulate, obtuse, incurved, 7-9 mm long, 2-4 mm wide; midlobe 2-lobate, with narrow base less than 1/2 the width of the apex, the disk with a complex callus centrally of 7 rows of teeth, the central row with smaller teeth. Column 2-3 mm long, 4-5 mm wide, with very broad wings with dentate margins; anther papillose; pollinia 2, pyriform, with minute stipe and viscidium. Capsules obovoid, ca. 1.2-1.5 cm long, pedicel ca. 1.4 cm long.

Lockhartia oerstedii is a midcanopy epiphyte of evergreen premontane and lower montane forests at 1100–1800 m. Flowering December to May, August to September, and perhaps throughout the year. Reported from Mexico to Panama and Colombia.

This species has among the largest and most attractive flowers of the genus. It is distinguished from the similar *L. amoena* Endr. & Rchb. f. by the more slender shoots, the more compact inflorescences, and the more complex callus with 7 rows of teeth.

Lockhartia pittieri Schltr., Repert. Spec. Nov. Regni Veg. 12:216. 1913. TYPE: Panama, Pittier (drawing of type: AMES). Lockhartia variabilis Ames & C. Schweinf., Sched. Orch. 8: 81–82. 1925. TYPE: Panama, near Frijoles, Powell 355 (holotype: AMES). Lockhartia integra Ames & C. Schweinf., Sched. Orch. 10: 108. 1930. TYPE: Costa Rica, Guanacaste, El Silencio, near Tilarán, Standley & Valerio 44675 (holotype: AMES). Figure 32B.

Plant an erect or pendent epiphyte 15-20 cm tall; rhizome short, roots < 1 mm in diameter. Leaves densely imbricate, triangular in profile, 2-3.5 cm long, 2.5-6 cm wide, acute. Inflorescence short, 1-apparently few flowers, lateral on the upper ½ of the stem; ovary and pedicel 9-10 mm long, subtended by an ovate, cordate, acuminate bract 3.5 mm long and 2.5 mm wide. Flowers yellow with orange-brown callus, ca. 1.4 cm high, 1 cm wide. Sepals concave, elliptic-ovate, reflexed at the base, 5-6 mm long, 4-5 mm wide; apex dorsally carinate, acute. Petals ovate-lanceolate, dorsally carinate, 6-8 mm long, 5-6 mm wide, acute. Lip convex, generally obovate to subquadrate, 8-9 mm long, 5-6 mm wide; apex 2-lobate; callus ovate, concave, margin lightly pilose, with 3 fleshy keels at the base, the central larger than the lateral. Column stout with broad, denticulate wings for the entire length, 3 mm long; pollinia 2 with caudicles, obovoid, with stipe and small viscidium. Cap**sule** suborbicular to ellipsoid, 8–10 mm long, pedicel ca. 1 cm long.

Epiphytic in midcanopies in humid tropical forests at 30–800 m. Flowering November to May. Belize to Panama; also reported from Ecuador.

Plant is similar to that of *L. hercodonta* Rchb. f. ex Kraenzl. but lives at lower elevations, and the flowers are larger and yellow.

Lockhartia pittieri Schltr. is based on a type from Panama with a 4-lobate lip, a feature that may be an artifact. For the moment we are following others in accepting this as the oldest available synonym for *L. integra* Ames & C. Schweinf., which is based on Costa Rican material with a 2-lobate lip.

Macroclinium Barb. Rodr.

(F. Pupulin and D. E. Mora de Retana)

REFERENCE—F. Pupulin, New and critical *Macroclinium* (Orchidaceae) from Central America. Lindleyana 11:135–140. 1996.

Plant perennial, epiphytic, cespitose, sympodial with pseudobulbs or submonopodial without. Pseudobulbs when present more or less inconspicuous, ovoid or rounded, compressed, apically 1-foliate, concealed by leaf sheaths. Leaves usually 3-7 (34) per shoot, conduplicate, laterally flattened, the basal ones articulate with imbricate sheaths often provided with hyaline margins; blades linear-lanceolate to subfalcate-lanceolate. Inflorescence lateral, subumbellate or elongate with flowers well separated, often branched, 2-many-flowered, often successive, arising from the axils of the upper leaf sheaths. Flowers small, hyaline. Sepals free or shortly connate, **petals** similar to the sepals, spreading. Lip free or adnate to the column base, with or without calli or lateral lobules near the base. Column slender, linear-clavate, sometimes abruptly and dorsally reflexed at the apex, sometimes slightly adnate to the lip, foot lacking; pollinia 2, strongly compressed, supported on a slender, triangular stipe. Fruit a capsule.

A genus of about 38 species distributed from southern Mexico to Brazil, generally as twig epiphytes on the upper or the outer portion of the canopy. Fifteen species are reported from Central America, 10 of which occur in Costa Rica. Phylogenetically, *Macroclinium* has several derived character states within the *Rodriguezia* clade (Chase & Palmer, 1992), a group of orchids specialized to occupy the more xeric habitat of twigs in Neotropical canopies, including *Ionopsis*, *Trizeuxis*, *Notylia*, *Warmingia*, and *Macradenia*.

Key to the Species of Macroclinium

1a.	Inflorescence a raceme with flowers well separated
	2a. Callus of the lip papillose-hirsute
	2b. Callus of the lip glabrous
	3a. Lateral sepals free; lamina of the lip cordate-sagittate
	3b. Lateral sepals connate; lamina of the lip ovate
1b.	Inflorescence subumbellate, the flowers close together 4
	4a. Lip without lateral, retrorse auricles
	4b. Lip with two lateral, retrorse auricles at base
	5a. Lip ecallose M. doderoi
	5b. Lip with a basal callus between auricles
	6a. Column with abruptly and dorsally reflexed apex
	7a. Lip free from the column; callus of the lip with transverse hairs
	M. glicensteinii
	7b. Lip adnate to the base of the column; callus glabrous
	8a. Lamina of lip cordate, with a single callus between auricles M. allenorum
	8b. Lamina of the lip hastate, with 2 membranous calli between auricles
	M. generalense
	6b. Column without such a reflexed apex
	9a. Pseudobulbs > 1 cm long
	9b. Pseudobulbs < 1 cm long

Macroclinium allenorum Dressler & Pupulin, Lindleyana 11:34–36. 1996. TYPE: Costa Rica, Puntarenas, vicinity of Palmar Norte, Río Terraba, *Allen 5244* (holotype: US; isotypes: F, SEL).

Plant epiphytic, cespitose, small. Rhizome short, roots filiform. Pseudobulbs inconspicuous, compressedellipsoid, 4-8 mm long, closely invested by 3-5 conduplicate, leaf-bearing sheaths, apex 1-foliate. Leaves conduplicate, laterally flattened, lanceolate to narrowly elliptic-lanceolate, 12-25 mm long, 2.8-5.8 mm wide; the basal leaves articulate to the broad sheaths with hyaline margins. Inflorescence a simple subumbellate raceme, becoming paniculate, 1.5-11 cm long, provided with 2-3 conspicuous, concave, acute bracts 8-11 mm long, 5 mm wide; ovary with pedicel subclavate, subtended by a lanceolate floral bract, shorter than the pedicellate ovary. Flowers small; sepals white, hyaline; petals white, spotted with rose-red; lip lavender. Sepals dissimilar; dorsal lanceolate-elliptic, acuminate, cucullate, 5.5-7 mm long, 0.8-1.3 mm wide; lateral sepals oblonglanceolate, acuminate, free, dorsally carinate, 6-8 mm long, 0.8-1 mm wide. Petals obliquely lanceolate, acuminate, 4.7-6 mm long, 0.8 mm wide. Lip with a linear claw ca. 2 mm long, adnate to base of column for more than 1/3 of claw; blade 5-5.5 mm long, triangular-cordate, with serrulate margins, acuminate to mucronate, the midlobe unguiculate, the isthmus subequal to basal claw with 2 short retrorse auricles near the base, with thickened, glabrous callus between auricles. Column slender, ca. 5 mm long, abruptly dorsally reflexed at apex; anther triangular, cucullate; pollinia 2, compressed, on a long, triangular stipe; viscidium elliptic.

Epiphytic in moist premontane forests at 0-400

m. Flowering December to May. Costa Rica; supposedly endemic in the region of Palmar Norte to Golfito.

Macroclinium allenorum may be distinguished from M. glicensteinii J. T. Atwood and M. generalense Pupulin by the lip with long claw partially adnate to the base of the column and by the cordate midlobe with serrulate margins. In addition, both the transverse hairs on the callus of M. glicensteinii and the two membranous calli of M. generalense are absent in M. allenorum.

Macroclinium confertum Pupulin, Lindleyana 11:138–140. 1996. TYPE: Costa Rica, San José, Dota, San Marcos, road to San Joaquín, *Pupulin 204* (holotype: USJ). Figure 32C.

Plant epiphytic, small, cespitose, sympodial. Rhizome short, roots filiform. Pseudobulbs inconspicuous, ovate, somewhat compressed, 6-7 mm long, 4.5-5 mm wide, covered at the base by 3-7 leaf-bearing sheaths, apex 1-foliate. Leaves conduplicate, laterally flattened, linear-lanceolate to subfalcate-lanceolate, to 5.5 cm long, 6 mm wide, acute; the basal leaves articulate to sheaths with hyaline margins. Inflorescence a pendent raceme with many flowers (11-13), to 8 cm long, provided at the base with 2-3 lanceolate, subulate bracts ca. 4 mm long; ovary with pedicel subclavate, to 7 mm long, subtended by a lanceolate, acuminate, floral bract ca. 3 mm long, 1.5 mm wide. Flowers rather large for the plant; sepals white, hyaline; petals pale rose to lavender spotted with purple; lip lavender. Sepals dissimilar; dorsal concave, linear-lanceolate, acuminate, to 16 mm long,

2.2 mm wide; lateral sepals shortly connate for ca. 1 mm, somewhat concave toward the base, narrowly linear-lanceolate, ca. 1.6 cm long, 1.3 mm wide, acuminate to setaceous. Petals obliquely lanceolate, to 1.2 cm long, 1.9 mm wide, acuminate to setaceous. Lip with linear claw 1 mm long free from the column; blade 9.7–10.1 mm long, 2 mm wide at the middle, the base narrowly cuneate and with a pair of triangular, deflexed, and somewhat twisted auricles; apex setaceous; margins crisped; callus between auricles glabrous, obtrullate. Column slender, clavate, ca. 4 mm long, with cuneate, acute apex; anther cucullate; pollinia 2, strongly compressed; stipe hyaline, elongate, triangular; viscidium elliptic, brown.

Epiphytic on lower twigs in wet premontane forests at 1300–1500 m. Flowering at least May to June. Endemic to valleys of the Dota region in central Costa Rica.

The shortly connate lateral sepals, the blade of the lip with ovate central portion, and the obtrullate, glabrous callus easily distinguish *M. confertum* from its closest allied species, *M. ramonense* (Schltr.) Dodson and *M. robustum* Pupulin & Mora-Retana.

Macroclinium cordesii (L. O. Williams) Dodson,
Icon Pl. Trop. 10: t. 938. 1984. Notylia cordesii
L. O. Williams, Ann. Missouri Bot. Gard. 26:
286. 1939. TYPE: Panama, Bocas del Toro,
Mosquito Hill, Cordes ex Woodson, Allen, &
Seibert 1932 (MO, not seen). Figure 33A.

Plant epiphytic, cespitose, small. Rhizomes short, roots filiform, < 1 mm in diameter. Pseudobulbs compressed, obovoid-ellipsoid, 1-1.5 cm long, 4 mm wide, concealed at the base by ca. 4 leaf sheaths, apex 1-foliate. Leaves equitant, sessile, linear-lanceolate to ovatelanceolate, 4-7 cm long, 3-5 mm wide, acute to acuminate. Inflorescence a simple subumbellate raceme or panicle with subumbellate branches, each subumbel with 5-6 flowers; peduncle slender, 4.5-6 cm long, with several triangular, funnelform bracts 1.5-2 mm long; ovary with pedicel to 9 mm long, subtended by a scarious, lanceolate, spreading, acute to acuminate floral bract 1.5-2 mm long. Flowers small; sepals white, hyaline; petals lavender tinged with rose-purple near the base; lip and column purple. Sepals similar, linear-lanceolate, acuminate; dorsal ca. 10 mm long, 1.25 mm wide; lateral sepals slightly oblique, 1.2-1.3 cm long, 1 mm wide. Petals similar to the dorsal sepal but slightly narrower, ovate-lanceolate, abruptly attenuate toward the apex, ca. 1 cm long, 1 mm wide. Lip free from the column, with claw 4 mm long; blade with a basal isthmus, provided at the base with an obscurely papillose thickening and 2 retrorse auricles, then abruptly hastate, acuminate, to 5 mm long, 2 mm wide; lateral lobes somewhat recurved, serrate; apex strongly acuminate. Column slender, ca. 4 mm long with prominent foot; anther subglobose; pollinia 2, pyriform, strongly compressed, long triangular stipe.

Macroclinium cordesii is a rare species from the coastal plains of the Province of Limón. Flowering late August to October. Costa Rica and Panama.

Among Costa Rican *Macroclinium* species (especially *M. paniculatum* (Ames & C. Schweinf.) Dodson) with subcapitate inflorescences, *M. cordesii* may be distinguished by the straight, not abruptly reflexed, column and the conspicuous pseudobulbs.

Macroclinium doderoi Mora & Pupulin, Selbyana 18:7. 1997. TYPE: Costa Rica, Province of Cartago, Turrialba, Caño Seco Torito, *Dressler et al. s.n.* (holotype: USJ; isotype: USJ).

Plant epiphytic, pendent. Rhizome short; roots filiform, ca. 1 mm in diameter. Pseudobulbs inconspicuous, elliptic-obovate, ca. 3.5 mm long, 2 mm wide, concealed by 3-5 leaf sheaths, apex 1-foliate. Leaves conduplicate, compressed, lanceolate to narrowly ellipticlanceolate, 1.2-1.8 cm long, 2 mm wide, acute, articulate to the imbricate sheaths with hyaline, scarious margins. Inflorescence a simple subumbellate raceme or panicle with many subumbellate branches produced successively from the last bud below the rachis of the terminal flower cluster, lax, to ca. 4 cm long, with 5-6 flowers per subumbel; ovary with pedicel subclavate, ca. 7 mm long, subtended by a shorter, triangular, acuminate, floral bract. Flowers large for the plant, tepals white, hyaline, petals with a purple blotch near the base; column and lip lavender to purple. Sepals similar; dorsal lanceolate, ca. 9 mm long, 1.6 mm wide, attenuate; lateral sepals narrowly lanceolate, ca. 1.1 cm long, 1.1 mm wide, long-attenuate. Petals ovate-lanceolate, falcate, ca. 9 mm long, 1.3 mm wide, attenuate. Lip free, inserted at a very narrow angle with the column, with short claw 0.9 mm long; blade slightly incurved toward the column, abruptly sagittate, ca. 7.5 mm long, 2 mm wide at midpoint, with 2 short, twisted lobes near the base; margins erose-dentate; callus none. Column terete, slender, 5.5 mm long, with abruptly reflexed apex; anther cucullate, narrowly ovate-triangular; pollinia 2, ovate-pyriform, strongly compressed, with long triangular stipe with lateral projections apically; viscidium elliptic, brown.

Epiphytic and endemic in moist tropical forests of the Central Valley of Costa Rica. Flowering late June through August.

Macroclinium doderoi may be easily distinguished from its Costa Rican relatives by a unique combination of characters including the subcapitate inflorescence, the lip entirely free from the column, the very short claw, and the absence of a callus between the lateral lobes of the lip.

Macroclinium generalense Pupulin, Lindleyana 11:136–138. 1996. TYPE: Costa Rica, San José, Pérez Zeledón, Alto de San Juan, *Pupulin* 24 (holotype: USJ). Figure 32D.

Plant epiphytic, small, cespitose. Rhizome short; roots filiform, glabrous. Pseudobulbs inconspicuous, compressed, ellipsoid, to 5 mm long, 4 mm wide, concealed by 3-5 leaf sheaths, apex 1-foliate. Leaves conduplicate, laterally flattened, lanceolate to narrowly elliptic-lanceolate, to 4 cm long, 1 cm wide, acute, the basal leaves articulate to imbricate sheaths provided with broad, hyaline, scarious margins. Inflorescence subumbellate, with lateral, subumbellate branches produced consecutively from the last bract of the inflorescence below the rachis, few-flowered, to 11 cm long, provided at the base with 3-5 conspicuous, ovate, concave, acute bracts 8-11 mm long, 5 mm wide; ovary with pedicel subclavate, to 6 mm long, subtended by a lanceolate, acuminate floral bract to 4 mm long. Flowers small, hyaline, sepals white, petals pale rose spotted with purple, lip lavender. Sepals similar; dorsal lanceolate-elliptic, cucullate, to 1.2 cm long, 3.5-4 mm wide, acuminate; lateral sepals free, dorsally carinate, oblong-lanceolate, ca. 1.1 cm long, 3-3.5 mm wide, acuminate. Petals obliquely lanceolate, acuminate, to 1.2 cm long, 3.5 mm wide. Lip shortly clawed, sagittate, to 1.1 cm long, acuminate; claw linear, ca. 2 mm long, with more than 1/3 adnate to column base; blade with 2 short, retrorse, twisted auricles at the base and 2 membranous, slightly thickened, glabrous calli between the auricles; basal portion of the blade narrowly linear cuneate, gradually expanded into the distal, triangular-rhombic portion, with irregular margins, apex acuminate. Column slender, abruptly dorsally reflexed at the apex; anther triangular, cucullate; pollinia 2, pyriform, strongly compressed laterally on a long triangular, hyaline stipe; viscidium elliptic, brown.

Epiphytic and endemic in the northern part of the Valle del General in Costa Rica. Flowering January through April.

The triangular-rhombic blade of the lip with the short claw adnate to the column and the presence of two membranous, glabrous calli easily distinguish *M. generalense* from its close allies, especially *M. glicensteinii* J. T. Atwood.

Macroclinium glicensteinii J. T. Atwood, Selbyana 10:60. 1987. TYPE: Costa Rica, Vara Blanca, *OIC 7473* (holotype: SEL). Holotype originally collected by L. Glicenstein.

Plant epiphytic, cespitose, small. Rhizome short; roots filiform, to 1 mm in diameter. Pseudobulbs ovate, compressed, inconspicuous, to 4 mm long, concealed by the base of leaf sheaths, apex 1-foliate. Leaves sessile, conduplicate, laterally flattened, narrowly elliptic, 2–4 cm long, 3 mm wide; sheaths with conspicuous hyaline margins. Inflorescence subumbellate, sometimes with more than a subumbel developing from the same peduncle; peduncle slender, with lanceolate subulate bracts each sometimes developing a subumbel basipetally; ova-

ry with pedicel 1 cm long, subtended by a lanceolate floral bract 3–4 mm long. Flowers small, pale lavender with spotting mostly on the petals. Sepals similar, subconduplicate, narrowly elliptic-attenuate, 1.1–1.4 cm long, 1.5 mm wide. Petals lanceolate-attenuate, 8–12 mm long, to 1.5 mm wide. Lip free from the column, with a short claw, 3.5 mm long, presenting 2 auricles and 2 membranous calli apically, below which are numerous papillae and between which are transverse hairs; blade of the lip hastate, 5–7 mm long, 2–2.5 mm wide, acuminate, with irregularly crenulate margins, the apex strongly acuminate. Column slender, the apex abruptly dorsally reflexed, 7–8 mm long; anther cap ovate-subulate; pollinia 2, pyriform, strongly compressed, with long cuneate stipe.

Originally described from a cultivated specimen, *M. glicensteinii* is endemic to Costa Rica, where it probably lives in moist montane forests in the region of Dota. Flowering in cultivation (Connecticut) in December.

The presence of a few long, transverse hairs on the callus at the base of the blade of the lip and the short claw completely free from the column are distinct features for field recognition. This species is known only by the type collection.

Macroclinium lineare (Ames & C. Schweinf.) Dodson, Icon. Pl. Trop. 10: t. 938. 1984. *Notylia linearis* Ames & C. Schweinf., Sched. Orch. 8:72. 1925. TYPE: Costa Rica, La Fuente, East Turrialba, *Alfaro s.n.* (holotype: US).

Plant epiphytic, cespitose, small. Roots filiform. Pseudobulbs elliptic, to 7 mm long, 3 mm wide. Leaves conduplicate, spreading, laterally flattened, semielliptic to linear-oblong, sharply acute, sessile, 1-3 cm long, 2.5-4.5 mm wide; imbricate sheaths with broad, scarious, hyaline margins. Inflorescence subumbellate, semiglobose; peduncle slender, flexuous, suberect, to 4 cm long, with 3 funnelform, acuminate bracts; ovary with pedicel subclavate, 7 mm long, subtended by a narrowly lanceolate, acuminate, concave, spreading, floral bract 1.8-2 mm long. Flowers large for the plants; sepals white, hyaline; petals tinged with rose-purple; lip purple. Sepals similar; dorsal strongly concave, narrowly lanceolate, dorsally conspicuously carinate, ca. 1 cm long, 1.8-2 mm wide, apex caudate-acuminate; lateral sepals free or very shortly connate forming a saccate base, lanceolate-linear, 1.2-1.3 cm long, 1 mm wide; apex long acuminate and conduplicate. Petals similar to the dorsal sepal, 9–10 mm long, ca. 1.5 mm wide, caudate. Lip free from the column, linear, contracted near the base, tapering to the carinate tip, 5-9 mm long, ca. 1 mm wide above the middle, shortly acuminate, with a clump of low, approximate papillae near the base. Column slender, ca. 3 mm long; pollinia 2, pyriform, strongly compressed, with long cuneate stipe.

Epiphytic and rare in wet premontane forests at the typical locality near Turrialba, along the At-

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lantic slopes of Parque Nacional Braulio Carrillo, and in northern Valle del General at 1100–1200 m. Flowering at least August and September. Costa Rica, Panama, Colombia, and Ecuador.

Macroclinium lineare is unmistakable for its linear lip lacking auricles and for the clump of slender papillae at the base.

Macroclinium paniculatum (Ames & C. Schweinf.) Dodson, Icon. Pl. Trop. 10: t. 938. 1984. *Notylia paniculata* Ames & C. Schweinf., Sched. Orch. 10:102. 1930. TYPE: Costa Rica, Cartago, vicinity of Pejivalle, *Standley & Valerio* 46858 (holotype: AMES).

Plant epiphytic, cespitose, small. Rhizome short; roots filiform, < 1 mm in diameter. Pseudobulbs inconspicuous, suborbicular, compressed, sulcate, 7 mm long, 5 mm wide; concealed by 4 scarious, leaf sheaths; apex 1-foliate. Leaves densely rugose, conduplicate, laterally flattened, narrowly lanceolate to narrowly elliptic-lanceolate, 2.5-3.5 cm long, 3.5-5 mm wide, acute. Inflorescence subumbellate, subequaling or surpassing the leaves, commonly with successive short branches, fewflowered in each branch; floral bracts scarious, lanceolate, spreading, 3-3.5 mm long, much shorter than the ovary with pedicel 6 mm long. Flowers large for the plant; sepals white, hyaline; petals pinkish white tinged with rose-purple; lip purple. Sepals dissimilar; dorsal ovate-lanceolate, cucullate, 6-7 mm long, 1.2-1.6 mm wide, shortly acuminate; lateral sepals nearly ½ connate, each oblong-lanceolate, dorsally carinate near the apex, ca. 9 mm long, 1.2-1.3 mm wide, mucronate. Petals ovate-lanceolate, 6-7 mm long, 1.8-2 mm wide, acuminate. Lip free from the column, with a long claw slightly dilated and thickened near the blade; the blade sagittate at the base, 3 mm long, 2 mm wide, the upper ½ triangular-cordate, apex sharply mucronate; margins irregularly crenate; callus consisting of a central, longitudinal fleshy keel and a pair of fleshy auricles at the base of the blade. Column slender below, dilated above, 2.3 mm long; anther subglobose; pollinia 2, pyriform, strongly compressed, with long stipe.

Epiphytic and rare in premontane wet forests at 600-800 m. Flowering at least February (type) and April. Nicaragua to Costa Rica.

The sagittate lip with callus consisting of a central keel and fleshy auricles at the apex of the claw and the cordate, mucronate anterior portion of the blade are useful characters for field recognition.

Macroclinium ramonense (Schltr.) Dodson, Icon. Pl. Trop. 10: t. 939. 1984. *Notylia ramonensis* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 250–251. 1923. TYPE: Costa Rica, Santiago de San Ramón, *Brenes 91* (isotype: CR). Figure 33B.

Plant epiphytic, small, cespitose, pendent. Rhizome short; roots filiform, < 1 mm in diameter. Pseudobulbs obovate-ellipsoid, compressed, ca. 1.5 cm long, 5-6 mm wide, protected at the base by 2-5 conduplicate leaf-bearing sheaths; apex 1-foliate. Leaves rugulose, conduplicate, laterally flattened, ligulatelanceolate, subfalcate, acute, to 4.5 cm long, 4–8 mm wide; basal leaves articulate to sheaths provided with conspicuously hyaline, scarious margins. Inflorescence a pendent raceme, with many flowers (to 30), to 13 cm long, provided with triangular, acute bracts ca. 1.5 cm long; ovary with pedicel linear-subclavate, ca. 8 mm long, subtended by a lanceolate, acuminate, spreading floral bract 3 mm long. Flowers large for the genus, sepals white, petals pale lavender with purple blotches, lip lavender. Sepals subequal; dorsal linear-lanceolate, concave, acuminate, 1.7 cm long, 2.1-2.5 mm wide; lateral sepals obliquely linear-lanceolate, slightly concave, acute, 1.6-1.7 cm long, ca. 2 mm wide. Petals obliquely linear-lanceolate, long-attenuate, ca. 1.3 cm long, 1.9 mm wide. Lip with a linear, terete, slender claw 1.8 mm long, shortly adnate to the column; blade 6.5 mm long, 3.7 mm wide at the middle, the base with a pair of short, rounded, twisted auricles, then abruptly anchor-shaped; apex sharply attenuate; margins erose; callus between the auricles glabrous, narrowly elliptic. Column slender, terete, ca. 3 mm long; anther ovate-cucullate, truncate; pollinia 2, subtriangular, strongly compressed on a long, triangular, attenuate stipe; viscidium elliptic, brown.

Native to moist evergreen forests at 950(type)–1500 m. Flowering at least August and September. Costa Rica and western Panama.

Among Costa Rican species of *Macroclinium, M. ramonense* has the widest distribution, ranging from Monteverde southward along the Cordillera de Tilarán to southern and western drainage of Cordillera Central just to the western slopes of Cerro Vueltas of the Dota region. Among the species with elongate, rather than condensed, racemes, it is easily distinguished by the anchor-shaped blade of the lip and the narrowly elliptic callus. The long claw of the lip and prominent, central callus readily distinguish this from *M. bicolor*, with which it has been confused.

Macroclinium robustum Pupulin & Mora, Selbyana 18:7–10. 1997. TYPE: Costa Rica, Province of San José, Alajuelita, *Pupulin & Flores* 315 (holotype: USJ; isotype: USJ).

Plant epiphytic, cespitose, pendent. Rhizome short; roots filiform, ca. 1 mm in diameter. **Pseudobulbs** ovate, to 8.5 mm long, 5 mm wide, concealed at the base by 2–5 leaf sheaths with hyaline, scarious margins. **Leaves** rugose, compressed, 5.3–6.2 cm long, 5–7 mm wide, acute, the basal leaves articulate with their sheaths. **Inflorescence** a lax raceme with 11–17

flowers, to 8.6 cm long, the base provided with 2 triangular, acute bracts 8 mm long; ovary with pedicel linear-subclavate, ca. 8 mm long, subtended by a triangular, acuminate, floral bract ca. 4.5 mm long. Flowers rather large for the genus; sepals greenish white, petals lavender with purple blotches, lip lavender. Sepals similar; dorsal concave, lanceolate, acuminate, dorsally carinate, 1.2–1.3 cm long, 3–3.5 mm wide; lateral sepals slightly concave, linear-lanceolate, 1.4-1.5 cm long, 1.8 mm wide, acute. Petals sigmoid, ovate-lanceolate, ca. 1.2 cm long, 1.5 mm wide, long-attenuate. Lip shortly adnate to the column; claw linear, terete, 3.2 mm long; blade inflexed toward the column 6 mm long, 2.6 mm wide, with 2 short, subquadrate, twisted lobes near the base, abruptly sagittate-cordate at the middle, margins erose; disk verruculose, with a papillose-hirsute callus. Column short, terete, slender at the base, 3 mm long, thickened abruptly at the reflexed apex; anther ovate-cucullate, apically mucronate; pollinia 2 ovate, strongly compressed; stipe triangular-elongate; viscidium elliptic, yellow.

Epiphytic and endemic in montane cloud forests of Costa Rica at 1850 m. Flowering late July and August.

In the type locality, this species was found growing exclusively on the introduced cypress *Cupressus lusitanicus. Macroclinium robustum* is the highest-growing species in Costa Rica and is unique for having both elongate inflorescences and flowers with papillose-hirsute calli. The long and stout claw easily distinguishes it from its closest relative, *M. ramonense* (Schltr.) Dodson.

Key to the Species of Mesospinidium

 1a. Lip 6–8 mm long, dorsal sepal oblong
 M. warscewiczii

 1b. Lip 4–6 mm long, dorsal sepal suborbicular
 M. horichii

Mesospinidium horichii Bock, Orchidee (Hamburg) 47:246. 1996. TYPE: Costa Rica, Atlantic rain forest, Sarapiquí jungles, near Cariblanco (holotype: HAL 75286, not seen). Figure 33C.

Plant a cespitose epiphyte to 30 cm tall. Rhizome short; roots 1–2 mm in diameter. Pseudobulbs small, lanceolate to ovoid, compressed, 3.5–4.5 cm long, 1.8–2 cm wide, subtended by 2–3 foliaceous, bracts, apically 1(2)-foliate. Leaves rather thin, carinate beneath, oblong-lanceolate to elliptic, 15–30 cm long, 3 cm wide, acute. Inflorescence a panicle of 15–20 flowers, lateral, 25–30 cm long with scape, pendent or arcuate, the peduncle covered by triangular, membranaceous bracts 7–9 mm long, 2–3 mm wide; ovary with pedicel 6–7 mm long; floral bract about 1 mm long. Flowers somewhat fleshy, 8–10 mm tall, 6–7 mm wide, yellowish with brownish spots. Sepals dissimilar;

Mesospinidium Rchb. f.

(D. E. Mora de Retana)

REFERENCE—N. H. Williams, A Reconsideration of *Ada* and the glumaceous brassias (Orchidaceae). Brittonia 24:93–110. 1972.

Epiphytic, cespitose **herb** of shady cloud and elfin forests. **Pseudobulbs** lanceolate to ovoid, little compressed laterally, subtended by 2 or more foliaceous sheaths; apex 1–2-foliate. **Leaves** light green, flexible, conduplicate, petiolate, acute to acuminate. **Inflorescence** arcuate or pendent, lateral at the pseudobulb base, usually paniculate, a raceme in young plants. **Flowers** fleshy, campanulate, greenish spotted with brown, the lip usually white or cream spotted with reddish brown. **Sepals** dissimilar, the laterals partially united. **Petals** ovate, acute, spreading. **Lip** simple, ovate to obovate, convex apically, margins usually revolute; callus a pair of fleshy keels at the base forming a concave depression. **Column** stout, without foot; pollinia 2, waxy, with relatively large stipe. **Fruit** a capsule.

A small genus of six to eight species ranging from southern Nicaragua (Volcán Mombacho) to Andean South America. *Mesospinidium* is rather easily recognized by the small, brown-spotted, greenish flowers on arcuate to pendent panicles. Plants are grayish green.

According to Williams, *Mesospinidium* is related to *Ada* and *Brassia*. No studies of DNA have been published that include this genus.

dorsal adnate to the petals at the base, papillose above, suborbicular, concave, apiculate, 5–6 mm long, 4–5 mm wide; lateral sepals elliptic, obtuse, ½ connate, prominently carinate, papillose above, 6–7 mm long, 3–4 mm wide. Petals lightly concave, acute to obtuse, recurved, 4–5 mm long, 2–3 mm wide. Lip simple, fleshy, articulate to the column base; blade ovate to suborbicular, or rhombic, 4–5 mm long, 3 mm wide; apex with reflexed apicule appearing emarginate in natural position; margin revolute; callus at the base fleshy, concave, bilamellate, pubescent between the lamellae. Column stout, 4 mm long, broadened at the base forming a prominent, rounded nectary, the margins with 2 lateral fleshy projections; pollinia 2, globose, with prominent stipe and viscidium.

This species grows in premontane rain forests at 800-1000 m. Flowering September and Octo-

ber. Costa Rica; also reported from Panama (R. L. Dressler, pers. comm.).

This species is distinguished from similar *M.* warscewiczii Rchb. f. by the smaller, fleshier flowers with suborbicular dorsal sepal and by the shorter lip. The name, *M. endresii* (Kraenzl.) Garay, has been misapplied to *M. horichii*.

Mesospinidium warscewiczii Rchb. f., Bot. Zeitung (Berlin) 10:929–930. 1852. Central America, Warscewicz (holotype: w). ?Mesospinidium endresii (Kraenzl.) Garay, Orchidee (Hamburg) 24:187. 1973. ?Solenidium endresii Kraenzl., Pflanzenr. 80:317. 1922. TYPE: probably Costa Rica, Endres (holotype: w). Figure 33D.

Plant a cespitose epiphyte to 25 cm tall. Rhizome short; roots to 1 mm in diameter. Pseudobulbs ellipticovoid, compressed, 2.3-3.5 cm long, 1.5-2 cm wide, subtended by 2-4 foliaceous bracts; apex 1(2)-foliate. Leaves petiolate; blade elliptic-lanceolate, subcoriaceous, carinate beneath, 10-25 cm long, 2.8-3.5 cm wide, acute. Inflorescence a panicle with 10-15 flowers, lateral, arcuate or subpendent, 20-25 cm long including the scape; scape concealed by lanceolate bracts to 7 mm long; ovary with pedicel 5-7 mm long. Flowers 9-13 mm tall, 6-8 mm wide, greenish yellow, tepals with redmaroon spots; lip white with orange-brown spots. Sepals dissimilar; dorsal free, oblong, concave, acute, 7-8 mm long, 4-5 mm wide; lateral sepals elliptic-ovate, carinate beneath, 11-12 mm long, 4-5 mm wide, the base 3/3 connate, the apices acute. Petals elliptic-lanceolate, porrect, somewhat concave, 5-6 mm long, 2-3 mm wide, acute. Lip simple, fleshy, obovate to subpandurate, 6-8 mm long, 4-5 mm wide, with rounded nectary at the base, the apex acute and reflexed appearing retuse, the margin somewhat plicate; callus at the base a pair of fleshy keels to about 3/3 the lip, pubescent. Column stout, 5 mm long, broadly canaliculate; pollinia 2, waxy, rounded, with viscidium and triangular stipe.

This species grows usually as small populations in premontane cloud forests at 600–1200 m. Flowering October to December. Reported from Nicaragua to Panama.

Mesospinidium warscewiczii differs from similar M. horichii Bock by the larger, less fleshy flower, the oblong dorsal sepal, and the notably larger lip.

Miltoniopsis Godefroy-Leb.

(D. E. Mora de Retana)

REFERENCE—L. A. Garay and G. C. K. Dunsterville, Venez. Orch. Ill. 6:276–278. 1976.

Epiphytic, cespitose herb of rather wet, usually midelevation habitats. Pseudobulbs ovoid, strongly compressed, subtended by 2 or more foliate sheaths, apex 1-foliate. Leaves conduplicate, soft and flexible, articulate. Inflorescence a lateral raceme at the base of the pseudobulb. Flowers large and showy. Sepals free, spreading. Petals similar to the sepals, recurved or reflexed, spreading. Lip larger than sepals or petals, united to column base by a central keel, with a pair of sharp, short, lateral lobes at the base. Column stout, without auricles or foot; pollinia 2, with stipe and viscidium. Fruit a capsule.

A genus of about six species ranging from Costa Rica to Andean South America. Two species are known in Panama, but only one is known in Costa Rica.

Little is known of the close relationships of *Miltoniopsis*. The 1-foliate pseudobulb, lip with both central keel adnate to the column, and the sharp lateral lobes are clearly inconsistent with *Miltonia*. Still, *Miltoniopsis* seems to belong to the *Oncidium altissimum* clade (see Chase & Palmer, 1992), including *Odontoglossum* and *Oncidium* (in part).

Miltoniopsis warscewiczii (Rchb. f.) Garay & Dunsterville, Venez. Orch. Ill. 6:278. 1976. Odontoglossum warscewiczii Rchb. f., Bot. Zeitung (Berlin) 10:692–693. 1852. TYPE: Panama, Chiriquí at 8000 ft, Warscewicz (holotype: w). Odontoglossum warscewiczianum Hemsley, Biol. Centr.-Amer. 3:277. 1883. Miltonia endresii Nicholson Ill. Dict. Gard. 2:368. 1888. Miltonia superba Schltr., Repert. Spec. Nov. Regni Veg. 3:249. 1907. Figure 34A.

Plant cespitose, epiphytic, gray-green, 20–30 cm tall. Rhizome short; roots 2 mm in diameter. Pseudobulbs ovoid-ellipsoid, 3.8-4.3 cm long, 1.5-2.5 cm wide, apically 1-foliate, subtended and nearly concealed by 4-6 foliaceous bracts arranged in a fan. Leaves and foliaceous bracts articulate, petiolate; blades abaxially carinate, oblong-elliptic, acute to acuminate, to 30 cm long, 2-3 cm wide. Inflorescence a lateral, 3-5-flowered raceme 25-30 cm long including the scape; scape with translucent, triangular bracts; ovary and pedicel 3.5-4.5 cm long subtended by short, acute bracts 4-6 mm long. Flowers very delicate, 4.5-6 cm high and 4.2-6 cm wide, white to pink with a wine red to salmon spot around the yellow callus; column white to magenta with white anther. Sepals 2.5-3.2 cm long, 1.2-1.6 cm wide; dorsal elliptic-obovate, erect, concave, obtuse and apiculate; lateral sepals elliptic to obovate, lightly reflexed, obtuse and apiculate when spread. Petals similar to the sepals, obovate, 2.8-3 cm long, 1.3-1.4 cm wide; apex recurved, obtuse, apiculate. Lip pandurate, broad, 3.5-4 cm long, about as wide; apex deeply emarginate, united to the column base by a narrow keel; callus at the base semicircular with fleshy and lightly elevated border. Column stout, 4-5 mm long; pollinia 2, waxy, with viscidium and short stipe. Capsules ellipsoid, 6-7 cm long including the beak; pedicel ca. 2 cm long.

Miltoniopsis warscewiczii grows in high tree crowns in premontane and lower montane cloud forests (the "rainbow zone") at 1000–1800 m, rarely at lower elevations in the area of La Virgen de Sarapiquí. Flowering October to December. Reported from Costa Rica and Panama.

In flower, this species is easily recognized by the large, white, rather flat flowers with a proportionately large, biblike lip. Sterile plants could be confused with *Ada chlorops* (Endr. & Rchb. f.) N. H. Williams, a species with smaller, nearly obsolete pseudobulbs and deeper-green leaves. They often grow together.

This species is most closely related to the South American *M. vexillaria* (Rchb. f.) Godefroy-Lebeuf, a species with somewhat larger and much more variably colored flowers. Both *Odontoglossum warscewiczianum* Hemsley and *Miltonia endresii* Nicholson are based on the same type as *Odontoglossum warscewiczii* Rchb. f.

Notylia Lindl.

(D. E. Mora de Retana, with help from R. L. Dressler)

Plant a small cespitose, sympodial, pseudobulbous epiphyte; rhizomes short; roots usually white, thin, cy-

lindric. Pseudobulbs conspicuous or hidden by 1 or more foliaceous sheaths, apex 1-foliate. Leaves conduplicate, usually broad and leathery. Inflorescence a lateral, pendent, or arcuate raceme borne at the base of the pseudobulb, usually many-flowered. Flowers small, usually white to cream or pinkish, often faintly spotted, subtended by narrow, acute bracts. Sepals narrow and acute, variously spreading; the lateral sepals usually variously connate, sometimes completely so. Petals similar to the sepals but narrower. Lip arrowhead-shaped or trulliform, acute and often attenuate, sometimes united to the base of the column. Column variously elongate, cylindric, straight, without a foot, without wings, with variously elongate rostellum, anther dorsal, enlarged; pollinia 2, waxy, supported on an elongate stipe and viscidium. Fruit a capsule.

A perplexing Neotropical genus of perhaps 50 species, many of which are extremely similar and difficult to distinguish. Three species are here treated for Costa Rica, although there may be at least one more (see note under *N. lankesteri*).

Notylia is most closely related to Macroclinium Barb. Rodr. (see Chase & Palmer, 1992), which is distinguished by the equitant leaf, often monopodial habit, usually subumbellate inflorescence, and more complex flowers. Notylia species have 1-foliate pseudobulbs and pendent lateral inflorescences with usually many flowers that have a characteristic appearance, even when out of flower.

Key to the Species of Notylia

1a.	Lateral sepals free to base	2
	2a. Lip narrowly acute	. trisepala
	2b. Lip subovate, obtuse	lankesteri
1b.	Lateral sepals at least ½ connate	N. pittieri

Notylia lankesteri Ames, Sched. Orch. 5:34. 1923. TYPE: Costa Rica, Province of Limón, Rio Estrella, sea level, *Lankester & Sancho 373* (AMES, photo seen). ?N. brenesii Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:249. 1923. TYPE: Costa Rica, San Pedro de San Ramón, *Brenes 173* (lectotype: CR; isotype: AMES, photo seen).

Plant cespitose, to about 15 cm tall. Pseudobulb ovoid, ca. 1.5 cm long, 1 cm wide. Leaves oblong-elliptic, rounded at the base, obtuse, 11–14 cm long, 2–3.5 cm wide. Inflorescence a lateral raceme 4–16 cm long, densely flowered; floral bracts 4–5 mm long. Flowers aromatic, fleshy, white; petals with orange spots. Sepals similar, ca. 5 mm long, 3 mm wide; dorsal concave; lateral free, elliptic-ovate. Petals elliptic, obtuse, ca. 4 mm long, 2.5 mm wide, thickened at the

unguiculate base. **Lip** short-unguiculate; ca. 4 mm long, 2–2.5 mm wide; blade ovate to lanceolate, acute, the tip compressed; margins ascending; callus triangular, erect near the base. **Column** fleshy, stout, ca. 3 mm long.

Epiphytic in moist forests at 0–1500 m. Flowering at least November. Apparently endemic to Costa Rica.

Notylia lankesteri is distinguished from other species by the free sepals and obtuse lip. The sepals and petals are notably fleshy. The original description indicates that the flowers are "pungently spicy." Much of the above description is taken from the original description.

One of our reviewers analyzed a flower from the type of *Notylia brenesii* Schltr. and found that the lip is long-attenuate as described and similar in shape to an elephant's trunk. This may prove to be different from the species here described.

Notylia pittieri Schltr., Beih. Bot. Centralb. 36(2):418. 1918. TYPE: Costa Rica, Sur les Crescentia a Boruca, *Pittieri 6850* (AMES, drawing of type). Figures 34C,D.

Plant epiphytic, cespitose, forming small clumps ca. 12 cm tall. Rhizome very short; roots slender, ≤ 1 mm in diameter. Pseudobulbs ovate to oblong, apically 1-foliate, somewhat flattened, sulcate, 0.5-3.5 cm long, 0.4-1 cm wide, subtended by 2-3 foliaceous bracts. Leaves somewhat fleshy, oblong to elliptic-lanceolate, 3-17 cm long, 0.8-3.5 cm wide, shortly petiolate, acute. Inflorescence a densely and successively flowered, pendent raceme, 3-20 cm long; ovary with pedicel 3 mm long, subtended by shorter, triangular, acute bracts. Flowers somewhat spreading, with tannish cream sepals; petals cream with brownorange spots; lip white. Sepals dissimilar, dorsal concave, ligular-lanceolate, 4-5.5 mm long, 1.6-1.7 mm wide; synsepal 3.7-4.5 mm long, 1.2-2.2 mm wide, minutely bidentate apically. Petals oblique, falcate-lanceolate, 3.3-4.5 mm long, 0.6-1.2 mm wide; acute and attenuate. Lip 3-3.7 mm long, 1-2.2 mm wide, with short claw ca. 0.5 mm long; blade subsagittate to lanceolate, acute, with prominent keel 1-1.5 mm on claw and base of the blade. Column slender, erect, 2-3 mm long; anther cucullate, elongate, pollinia 2, with stipe and small viscidium.

Epiphytic in moist and seasonally dry forests in Pacific lowlands at 0-500 m. Flowering March, April, and June to September. Costa Rica; to be expected in western Panama.

Notylia pittieri is distinguished by the green or tan-green sepals, the lateral sepals being nearly totally connate, and the trullate-lanceolate lip.

Notylia trisepala Lindl., Paxton's Fl. Gard. 3:45. 1852. TYPE: Guatemala, *Van Houtten* (κ). ?*N. turialbae* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:145–146. 1923. TYPE: Costa Rica, Turialba, *A. and C. Brade 1186* (AMES, drawing of type). *N. barkeri* of authors, not Lindl. Figure 34B.

Plant a cespitose epiphyte, ca. 15 cm tall. Rhizome very short; roots slender, ≤ 1 mm in diameter. Pseudobulbs ovoid, apically 1-foliate, largely concealed by 2–3 subtending bracts, 1–2.2 cm long. Leaves somewhat fleshy, abaxially carinate, elliptic to ovate-lanceolate, subpetiolate, obtuse, 5–13.5 cm long, 1.2–3 cm wide. Inflorescence a pendent raceme 12–25 cm long; ovary with pedicel 5 mm long, subtended by shorter, triangular, acute bracts. Flowers successive, white or greenish white, petals with orange-yellow bars near the base. Sepals free, similar; dorsal elliptic, 5–6 mm long, 1–2.5 mm wide; lateral sepals lance-elliptic to lance ovate, 4–6 mm long, 1–1.6 mm wide. Pet-

als similar to the sepals. Lip unguiculate, 3.5–5 mm long, 1–2 mm wide; blade triangular-ovate, acute, with prominent keel on claw and base of the blade. Column stout, 2.5–2.7 mm long; anther cucullate, elongate; pollinia 2, with stipe and small viscidium.

Epiphytic in moist forest at 100-900 m. Flowering January to April. Reported from Guatemala to Costa Rica; probably also in western Panama.

Notylia trisepala is distinguished by the white or greenish white flowers and free lateral sepals.

Oncidium Sw.

(D. E. Mora de Retana)

REFERENCES—Retana, D. E. M. de, and J. T. Atwood, Orchids of Costa Rica. 2. Icones Plantarum Tropicarum 15: pl. 1401–1500. 1992. Retana, D. E. M. de, and J. T. Atwood, Orchids of Costa Rica. 3. Icones Plantarum Tropicarum 16: pl. 1501–1600. 1993.

Epiphytic, rarely terrestrial, cespitose or rhizomatous herb. Pseudobulbs present to obsolete or absent, subtended by 0-several foliaceous bracts; apex 0-3-foliate. Leaves conduplicate, chartaceous to fleshy, flat to terete, petiolate to sessile, acute to obtuse. Inflorescence lateral at the pseudobulb base, a raceme of 1-several flowers or paniculate. Flowers small to large, generally showy, usually yellow with reddish brown spots, sometimes white or with purple spots, rarely wine red to pink. Sepals similar or the laterals dissimilar and often variously connate. Petals usually similar to the sepals but somewhat smaller, rarely larger. Lip divergent from the column forming an angle of at least 90°, usually fleshy, simple or 3-lobate, the midlobe often emarginate or 2-lobate; callus often complex comprising various plates and teeth. Column stout, footless, with a fleshy plate below the stigma (tabula infrastigmatica), the apex with or without conspicuous wings; pollinia 2, waxy, supported on a conspicuous stipe and viscidium. Fruit a capsule.

A Neotropical genus of about 450 species depending in part on circumscription. Twenty-eight species are known in Costa Rica, although there may be others hiding under the synonyms we accept. Although we exclude *O. luridum* Lindl., it may occur in mangroves along the Atlantic coast, as reported both south and north of Costa Rica.

According to Chase, *Oncidium* includes several distinct alliances, some more closely related to other currently defined genera than to other oncidiums. The key to genera of the Oncidiinae allows one to arrive at *Oncidium* through several couplets reflecting the incoherent diversity of this polyphyletic "genus."

Key to the Species of Oncidium

1a.	Plants with a single, fleshy flat or terete apical leaf, no foliaceous bracts; pseudobulbs small or essentially obsolete
	4b. Callus not noselike, with 3 ridges apically but lacking teeth
1b.	Plants with 2 or more flat leaves including foliaceous bracts, never fleshy except perhaps in O. ampliatum
	7a. Lip \geq 1.6 cm long
	6b. Lip yellow or greenish yellow when young, often marked with red to brown
	12b. Inflorescence a panicle, pseudobulb various

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		Pseudobulbs spotted with purplish brown
	2	21a. Foliaceous sheaths lacking, leaves somewhat fleshy
		O. ampliatum
	2	21b. Foliaceous sheaths present, leaves not fleshy 22
		22a. Tepals yellow with brownish midveins
		O. obryzatoides
		22b. Tepals not as above
		23a. Petals never spatulate, heavily blotched with
		brown or purple to $> \frac{3}{4}$ from the base; pseudo-
		bulb usually with 2 leaves O. dichromaticum
		23b. Petals distinctly spatulate, spotted only to $< \frac{1}{2}$
		from the base O. klotzschianum
		Pseudobulbs not spotted with purplish brown
		24a. Flowers ≤ 1.5 cm tall O. parviflorum
		24b. Flowers > 1.5 cm tall
		along midveins O. obryzatoides
5b.		ted with brown
		elliptic or ovate, strongly compressed, sharp-edged 27
		k brown with yellow tips O. ansiferum
		v brown spots O. stenobulbon
		r strongly compressed, nor suborbicular, rather lanceolate, ovoid
		ceous sheaths without articulations, inflorescence erect
		O. ensatum
		s articulate, inflorescence pendent
		$cel \ge 2.5$ cm long, pseudobulb ellipsoid with 1 apical leaf
		O. stenotis
		$cel \le 2.5$ cm long, pseudobulbs lanceolate, with 2-3 (rarely 1)
		lip about 2× as long as base below narrowest part of isthmus;
		s pointing laterally, callus at least as broad as long O. isthmi
		out as long as base, lateral lobes somewhat porrect; callus nar-
	rower than	long O. polycladium

Oncidium ampliatum Lindl., Gen. Sp. Orch. Pl. 202. 1833. TYPE: Panama and Colombia, *Cuming 1312* (holotype: K). *Oncidium bernoullianum* Kraenzl., Pflanzenr. IV. 50(Heft 80):231. 1922. TYPE: Guatemala, *Bernouli 339* (holotype: w). Figure 38D.

Plant epiphytic, cespitose or shortly creeping. Rhizome short; roots 1.5–4 mm in diameter. Pseudobulbs green with reddish brown markings, ovoid to orbicular, laterally flattened, coarsely rugose, 3.5–10 cm long, 3.5–8 cm wide, concealed when young by nonfoliaceous bracts, apically (1)2–3-foliate. Leaves somewhat petiolate; blades coriaceous, elliptic, 6–35 cm long, 3–8.5 cm wide, subacute to obtuse. Inflorescence lateral, a raceme when small, panicle when large, 35–70 cm long including the scape; ovary and pedicel 2.5–4 cm long. Flowers somewhat successive, 2.5–3.5 cm long, 2.2–3.5 cm wide, brilliant yellow, the sepals somewhat spotted with red-brown, also the lip with reddish brown surrounding the callus. Sepals similar, 5–9 mm long, 5–7 mm wide, obovate-spatulate, concave. Petals larger than the sepals,

with claw; blade 8–13 mm long, 6–9 mm wide, suborbicular. Lip 3-lobate, 1.8–3.5 cm long, 2.5–3.5 cm wide; lateral lobes small, 5–6 mm wide; midlobe reniform, emarginate, with undulate margins, forming a narrow isthmus basally; callus at the isthmus complex, fleshy, somewhat elevated, consisting of 2 teeth basally and 3 teeth apically. Column short, 3–5 mm long, with dentate column wings; anther bed dentate; pollinia 2, supported on a viscidium and very short stipe. Capsules ellipsoid, retaining floral segments, 2.5–3.5 cm long; pedicel 2–3.5 cm long.

Uncommon epiphyte in dry, deciduous to semideciduous forests of the Pacific lowlands at 0-800 m. Flowering December to April. Broadly distributed from Guatemala to Venezuela, Trinidad, and Peru.

Oncidium ampliatum is easily recognized even when sterile by the strongly rugose, apically usually 2–3-foliate pseudobulbs. The flowers are notable for their proportionately enormous, yellow lips.

Oncidium ansiferum Rchb. f., Bot. Zeitung (Berlin) 10:696. 1852. TYPE: Chiriquí, Warscewicz (holotype: w, photo seen). Oncidium lankesteri Ames, Sched. Orch. 4:53. 1923. TYPE: Costa Rica, Irazú Volcano, Lankester & Sandro 415 (holotype: AMES). Figure 40A.

Plant cespitose, epiphytic. Rhizome abbreviated, shortly climbing; roots white, 1-2 mm in diameter. Pseudobulbs elliptic-ovoid, strongly flattened laterally, furrowed when dry, 6-12 cm long, 3-6 cm wide; base subtended by 2-3 imbricate, foliaceous, bracts; apex 1-2-foliate. Leaves short to long-petiolate, strongly carinate abaxially, 1-2(3) at the pseudobulb apex; blade elliptic-lanceolate, obtuse to subacute, coriaceous, conduplicate at the base, 15-40 cm long, 2.5-5.5 cm wide. **Inflorescences** lateral, 1–2 at the base of the shoot, an erect or arcuate panicle, exceeding the leaves, 50-80 cm long; branches 15-20 cm long, with 4-6 flowers; ovary with pedicel 2-3.5 cm long. Flowers with tepals redbrown tipped with yellow, 3-3.5 cm in diameter; lip brilliant yellow with a brown border around the callus. Sepals and petals similar, free, reflexed, 1.5-1.7 cm long, 5-7 mm wide, with undulate margins. Lip 3-lobate, 1.5-2 cm long, 1.2-1.8 cm wide; lateral lobes small, rounded, 5-7 mm wide; midlobe emarginate, with denticulate margin; isthmus 3-5 mm wide; callus fleshy, consisting of 7 teeth, 5 in 1 plane, 2 lower at the apex. Column short, ca. 5 mm long, with prominent tabula infrastigmatica; column wings broad, dolabriform, with crenulate margins; anther papillose; pollinia 2, obovate, supported on a prominent stipe and viscidium. Capsules ellipsoid, 4.5 cm long; pedicel 2 cm long.

This species grows as a low-density epiphyte in cloud forests at (1000)1350–2200 m. Flowering December to June with peak in February to April. Costa Rica and Panama.

Oncidium ansiferum is easily recognized by the strongly compressed, sharp-edged pseudobulbs and by the tepals, which are dark brown with yellow apices. It is closely related to O. stenobulbon Kraenzl., which grows in dryer habitats, usually at lower elevations (800–1050 m). Plants of that species are more yellow-green and have shorter and proportionately broader leaves, yellow tepals spotted with less intense brown, and less pronounced column wings. From the regions of San Pedro and Santiago de San Ramón (850 and 1000 m, respectively) are two specimens that appear somewhat intermediate with O. stenobulbon and may represent natural hybrids.

The common name of "caite" has been applied to this species because the odd, flattened pseudobulbs are similar in shape to *caite*, a kind of sandal worn by campesinos.

Oncidium ascendens Lindl., Edwards's Bot. Reg. 28: sub t. 4. 1842. TYPE: Guatemala. Figure 35A.

Plant an erect or pendent, cespitose epiphyte; rhizome short, roots to 2 mm in diameter. Pseudobulbs minute, suborbicular, 5-8 mm in diameter; subtended by nonfoliaceous bracts; apex 1-foliate. Leaves terete, fleshy, dark green with reddish spots, 10-45 cm long, 6-1.2 cm in diameter, acute. Inflorescence lateral, paniculate, usually shorter than the leaf, 10-30 cm long including the scape; branches short; flowers congested; ovary with pedicel 7-8 mm long. Flowers with tepals greenish spotted with brown; lip yellow with spotted callus. Sepals similar, free, concave, shortly unguiculate, obovate, obtuse, 6-7 mm long, 3-5 mm wide. Petals similar to the sepals, shortly unguiculate, concave, obovate, obtuse, 6-8 mm long, 3-5 mm long, with undulate margins. Lip 3-lobate, 9-10 mm long, 8-9 mm wide; lateral lobes rounded, porrect, 3-4 mm long; midlobe emarginate to 2-lobate, reniform, forming a distinct isthmus at the base 2-3 mm wide. Column stout, about 3 mm long, with a pair of linear, curved wings apically; anther papillose; pollinia pyriform, supported on viscidium and oblanceolate stipe. Capsules ellipsoid, shortly beaked, 2.3 cm long; pedicel ca. 1 cm long.

Epiphytic in hot, humid, tropical lowland forests with a short dry season at 0–1000 m. Flowering January to March. Reported from Mexico to Costa Rica, Colombia, and the Caribbean.

Three terete-leaved species of *Oncidium* are recognized in Costa Rica, *O. ascendens, O. ce-bolleta* (Jacq.) Sw., and *O. teres* Ames & C. Schweinf. Of these species, *O. ascendens* is unique in the porrect lateral lobes and in the linear, incurved column wings.

The entire alliance around *O. ascendens* needs to be reexamined, and we make no attempt to repeat questionable synonymies published elsewhere.

Oncidium bracteatum Warsz. & Rchb. f., Bot. Zeitung (Berlin) 10:695. 1852. TYPE: Probably Panama, Chiriquí, Warscewicz (w). Oncidium paleatum Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:260–261. 1923. TYPE: Costa Rica, San Rafael de San Ramón, Brenes 206 (drawing of type: AMES). Oncidium henricigustavi Kraenzl., Pflanzenr. IV. 50(Heft 80):242. 1922. TYPE: Costa Rica, Endres 292 (w). Figure 38A.

Plant a cespitose epiphyte of large branches to 60 cm high; rhizome short; root 1–1.5 mm in diameter. Pseudobulbs ovate, compressed, sulcate, subtended by 2–4 foliaceous bracts, apex 1–2 foliate. Leaves elliptic-lanceolate, carinate abaxially, 15–40 cm long, 1.5–3.5 cm wide, conduplicate at the base; apex asymmetrically acute. Inflorescence lateral, paniculate, \leq 1.25 m tall,

peduncle scarious; primary branches subtended by cymbiform bracts 3.5-4.5 cm long, the base with short internodes and usually with 2 imbricate bracts; ovary with pedicel 1.5–2.5 cm long, subtended by glumaceous bracts 1.5–2.8 cm long, 8–10 mm wide when spread. Flowers brilliant yellow marked with dark brown, lip brilliant yellow with brown base and isthmus. Sepals dissimilar, elliptic, carinate abaxially, narrowed at the base, with undulate margins; dorsal 1.3-1.5 cm long, 5-6 mm wide, obtuse, apiculate; lateral sepals falcate, reflexed or not, 1.5-1.7 cm long, 5-6 mm wide, acute. Petals similar to the dorsal sepal, 1.3-1.5 cm long, 5-6 mm wide, obtuse, apiculate, margins undulate. Lip 3lobate, 1.3-1.6 cm long, 1.2-1.5 cm wide; lateral lobes at the base rounded, somewhat retrorse; midlobe reniform, deeply emarginate, forming a pair of rounded lobes; isthmus ca. 5 mm wide; callus fleshy, with a thick central keel, 4 lateral and 3 apical teeth. Column 6-8 mm long, tabula infrastigmatica with fleshy borders, wings slender; anther; pollinia, supported on an elongate stipe and viscidium. Capsules ellipsoid, 4.5–5 cm long; pedicel ca. 3 cm long.

Epiphytic on shady, larger branches in premontane and lower montane cloud forests at 1000–1700 m. Flowering mostly May to October; sporadically throughout the year. Costa Rica and Panama.

Oncidium bracteatum resembles O. storkii in the conspicuous inflorescence bracts, but the latter species has strictly secund branches and dull yellow flowers with much less pronounced lateral lobes.

The name O. paleatum has been misapplied to O. stenotis Rchb. f. (F. Hamer, Icon. Pl. Trop. 11: t. 1059), but the drawing of the type of O. paleatum shows a smaller, 2-foliate pseudobulb with very narrow leaves and long bracts subtending the primary branches of the inflorescence, which are consistent with O. bracteatum, not O. stenotis. Also, the original description of O. paleatum indicates a much smaller flower, consistent with O. bracteatum.

Oncidium bryolophotum Rchb. f., Gard. Chron. 738. 1871. TYPE: Central America, Veitch (w). Oncidium megalous Schltr., Repert. Spec. Nov. Regni Veg. 9:30. 1910. TYPE: Costa Rica, Esmeralda, Barba Massif, Biolley 7256. Oncidium asparagoides Kraenzl., Pflanzenr. IV. 50(Heft 80):175. 1922. TYPE: Costa Rica, Endres 127 (w). Oncidium microphyton Kraenzl. Pflanzenr. IV. 50(Heft 80):204–205. 1922. TYPE: Costa Rica, Endres s.n. (w). Figure 37D.

Plant most variable in size, 10–25 cm tall; roots slender, about 1 mm in diameter. **Pseudobulbs** ovoid to lanceolate, little compressed, 2–8 cm long, 1.5–2.5 cm wide; subtended by 2–3 foliaceous bracts; apex 1–2-foliate. **Leaves** shortly petiolate, blades elliptic-lanceolate, 7–25 cm long, 1–2.5 cm wide, acute. **Inflorescence** lat-

eral, paniculate, 6 cm-1 m, complexly branched; primary branches to 5-10 cm long, with a single fertile and many aborted flowers per branch with oblong-linear tepals; ovary with pedicel 1-1.5 cm long. Fertile flowers ca. 1.2–2 cm tall, yellow with reddish brown markings on the tepals and lower half of lip. Sepals dissimilar; dorsal shortly unguiculate, ovate, acute, 7-9 mm long, 4-5 mm wide; lateral sepals linear-lanceolate, acute, reflexed, 9-10 mm long, 2-3 mm wide. Petals similar to the dorsal sepal, shortly unguiculate, 7-9 mm long, 4-6 mm wide. Lip 3-lobate, nearly as broad at the base as across the midlobe, 1-1.5 cm long, 1-1.5 cm wide; lateral lobes bluntly triangular, 3-4 mm long; midlobe 1-1.5 cm wide, deeply emarginate forming 2 rounded lobes; isthmus ca. 4-5 mm wide; callus at the base with a central blunt keel and 4 rows of blunt teeth with additional teeth on the lateral lobes. Column ca. 5 mm long, with tabula infrastigmatica, the apex with a pair of large, porrect, rounded wings. Capsules 3.5 cm long including elongate beak, pedicel 1-1.5 cm long.

Epiphytic on larger branches of open canopies in premontane and lower montane cloud forests at 1000–2100 m. Flowering July to December. Costa Rica and Panama; probably to Peru.

Oncidium bryolophotum is easily distinguished by the asparagus-like, slender inflorescence, which is often seen waving in the wind. Each primary branch has a single fertile and numerous sterile flowers.

Plants from Costa Rica and Panama have often been accepted as *O. heteranthum* Poeppig & Endl., a species based on a Peruvian type (w) that has roots of larger diameter, inflorescences usually with two flowers per branch, and larger aborted flowers with obovate tepals. Most of the Ecuadorian specimens at SEL may be *O. bryolophotum* rather than *O. heteranthum* as labeled, but two specimens from Bolivia and Peru show root and inflorescence features consistent with the latter.

All living and preserved plants that we have seen from Costa Rica represent a single species that corresponds with *O. bryolophotum* and overdescribed by Fritz Kraenzlin and Rudolf Schlechter. Both *O. megalous* Schltr. and *M. asparagoides* Kraenzl. are straightforward *O. bryolophytum* Rchb. f. The type of *O. microphyton* Kraenzl. is a plant less than 10 cm tall with a few aborted flowers and a single fertile flower showing the characteristic lip shape of *O. bryolophotum*.

Oncidium cariniferum (Rchb. f.) Beer, Pract. Stud. Fam. Orch. 283. 1854. *Odontoglossum cariniferum* Rchb. f., Bot. Zeitung (Berlin) 10: 638. 1852. TYPE: Middle America. Figure 36A.

Plant a cespitose epiphyte. Rhizome short; roots 1–2

mm in diameter. Pseudobulbs sulcate, ovoid, 7-12 cm long, 4-6 cm wide, subtended by 2-4 foliaceous bracts when young, apex 2-foliate. Leaves coriaceous, carinate abaxially, elliptic-lanceolate, 15-40 cm long, 3-6 cm wide, base conduplicate, apex acute. Inflorescence a lateral panicle, 50-100 cm long including the scape; branches primary, 13-20 cm long; ovary with pedicel 2-3 cm long. Flowers 6-10 per branch, about 4 cm high, 2 cm broad; tepals greenish yellow spotted with reddish brown; lip white aging yellow, callus clear wine red, column white spotted with reddish brown. Sepals free, subequal, elliptic-lanceolate, acuminate; dorsal erect, carinate externally, 2.4–2.5 cm long, 6 mm wide; laterals subfalcate, strongly thickened and carinate apically, 2.4–2.6 cm long, 4–5 mm wide. **Petals** similar to the dorsal sepal, elliptic-lanceolate, carinate, apiculate, 2.4-2.5 cm long, 5-6 mm wide. Lip anchor-shaped, 1.8-2 cm long, 2.1-2.3 cm wide with conspicuous claw at the base, the blade reniform, shallowly emarginate, and apiculate; callus fleshy, elevated, with 2 high, short, lateral keels at the base, a low central keel, and a pair of ascending teeth in front. Column stout, a bit sigmoid in profile, about 1 cm long, broadened at the base, with 2 ascending projections below the stigma; pollinia 2, obovate, with prominent stipe and viscidium.

Epiphytic and uncommon on the larger branches of premontane and lower montane forests at 1000–2000 m. Flowering September to February. Costa Rica and Panama; doubtfully reported from Colombia and Venezuela.

The species is easily recognized by the white, anchor-shaped lip and chocolate brown tepals. The callus suggests a relationship with *Odontoglossum*, and we note the angle between the column and lip would also if the column were not reflexed at the base.

Oncidium carthagenense (Jacq.) Sw., Kongl. Vetensk. Acad. Nya Handl. 21:240. 1800. *Epidendrum carthagenense* Jacq. Select. Stirp. Amer. 228, t. 133, fig. 4. 1763. Figure 35D.

Plant epiphytic, cespitose with few shoots. Rhizome short; roots to 2 mm in diameter. Pseudobulbs nearly obsolete, about 1 cm long, 1 cm wide, concealed when young by bracts, apically 1-foliate. Leaves coriaceous to fleshy, elliptic, sharply keeled abaxially, conduplicate at the base, apically acute, 20-30 cm long, 6-8 cm wide. Inflorescence usually pendent, a lateral panicle 75–125 cm long including the scape, the nodes with triangular bracts; ovary with pedicel 1.5-2.5 cm long. Flowers with sepals and petals cream spotted with maroonbrown; 1.8-2.2 cm in diameter. Sepals similar, reflexed and unguiculate; blades concave, suborbicular, 9-12 mm long, 6-8 mm wide, obtuse, the margins undulate. Petals similar to the sepals but broader, 1.2-1.4 cm long, 7-9 mm wide, the margin strongly undulate. Lip 3-lobate, subpandurate, constricted on the upper half, 1.2-1.4 cm long, 8-10 mm wide; midlobe, reniform; lateral lobes somewhat fleshy with revolute margins; basal callus consisting of 4 fleshy tubercles, 2 near the base separated by a central furrow and 2 near the middle. **Column** 2 mm long, with a pair of 2-lobate wings apically; anther papillose; pollinia 2, rounded, sulcate, with viscidium and short stipe.

Epiphytic in humid but seasonally dry forests at 300–1100 m on trunks and large branches. Flowering June to August. Reported from Florida, West Indies, Central America, and much of tropical South America. The range may depend ultimately on the synonymies accepted.

Oncidium carthagenese is easily recognized in Costa Rica by the white maroon-spotted flowers, the relatively small, inconspicuous pseudobulb, and the large, fleshy leaves, after which it has earned the common name orejas de burro. Extensive synonymies published by authors reflect much variation over the range.

Oncidium cebolleta (Jacq.) Sw., Kongl. Vetensk. Acad. Nya Handl. 21:240. 1800. *Epidendrum cebolleta* Jacq., Enum. Pl. Carib. 30. 1760. TYPE: Colombia, Cartajena. Figure 35C.

Plant an erect or pendent, cespitose epiphyte. Rhizome short; roots 1.5-2 mm in diameter. Pseudobulbs globose, 1-foliate, 8-10 mm high and wide, mostly concealed by bracts. Leaves terete, canaliculate, green or spotted with reddish brown, apex acute, 26-40 cm long, 8-15 mm wide. Inflorescence a lateral panicle 25-40 cm long including the scape; ovary and pedicel 1-1.5 cm long. Flowers 1.9-2.2 cm tall, 1.4-1.7 cm wide; tepals greenish spotted with reddish brown; lip yellow with callus marked brown. Sepals similar, obovate, concave, obtuse and apiculate, 7-8 mm long, 4.5-5.5 mm wide. Petals spatulate with undulate margins, obtuse and apiculate, 8–9 mm long, 3.5–4.5 mm wide. Lip 3-lobate, pandurate, 1.3–1.5 cm long, 1.4–1.7 cm wide, with crenulate margins; lateral lobes suborbicular to obovate, obtuse or rounded, 5-8 mm long, 3-4 mm wide; midlobe emarginate; callus consisting of a large nose-shaped central keel and 2 lateral teeth. Column 3-4 mm long, with a pair of 2-lobate wings; anther papillose; pollinia 2, waxy, with conspicuous oblanceolate stipe and viscidium.

Epiphytic on larger branches and widespread in seasonally dry forests below 600 m. Flowering late December to March. Reported as widespread from Mexico through Central and South America.

Of the three species of terete-leaved oncidiums recognized in Costa Rica, O. cebolleta has the largest flower. It is most similar to O. teres Ames & C. Schweinf., but the column wings are 2-lobate, and the callus includes a pair of teeth flanking the central keel.

Oncidium cheirophorum Rchb. f., Bot. Zeitung (Berlin) 10:695. 1852. TYPE: Panama, Volcán,

Warscewicz (holotype: W, photo seen). Oncidium dielsianum Kraenzl., Pflanzenr. IV. 50(Heft 80):197, t. 198F. 1922. TYPE: Costa Rica, Endres (holotype: W, photo seen). Oncidium macrorhynchum Kraenzl., 1.c.:200, t. 198J. 1922. TYPE: Costa Rica, San Juan de Candelaria, Endres (holotype: W, photo seen). Oncidium cheirophorum var. exauriculatum Hamer & Garay, Las Orquídeas de El Salvador 2:176. 1975. TYPE: Costa Rica, Guanacaste, Tilarán, Standley & Valerio 46266 (holotype: AMES; Isotype: US). Oncidium exauriculatum (Hamer & Garay) R. Jiménez, Orquídea (Méx.) 12:270. 1992. Figure 38C.

REFERENCE—R. Jiménez Machorro, *Oncidium exauriculatum:* Una Orquídea localizada recientemente en Mexico. Orquídea (Méx.) 12:269–276. 1992.

Plant cespitose, sometimes densely so, epiphytic, ≤ 15 cm tall excluding the inflorescence. Rhizome short; roots about 1 mm in diameter. Pseudobulbs smooth, green, marked and suffused with brown, pyriform to suborbicular, somewhat compressed, apically 1-foliate, 1.5-3.5 cm tall, 1.5-2.5 cm wide, subtended by 2-3 foliaceous bracts. Leaves thin, 5-15 cm long, 5-14 mm wide, elliptic-lanceolate, shortly petiolate and conduplicate at the base, apically acute, with a prominent abaxial keel. Inflorescence a lateral panicle, 10-25 cm long, including the scape; ovary and pedicel 6-9 mm long. Flowers greenish yellow, 1-1.5 cm across. Sepals dissimilar, unguiculate, 5-6 mm long, 4-5 mm wide; dorsal erect, obovate, strongly concave, obtuse, apiculate; lateral sepals shortly connate, reflexed, subquadrate, retuse. Petals shortly unguiculate, reflexed, ovate, obtuse, apiculate, 5-6 mm long, 4-5 mm wide. Lip adnate to the base of the column, strongly 3-lobate, with a pair of fleshy glands at the base, 1.1-1.2 cm long, 1.2-1.4 cm wide; lateral lobes subquadrate, lightly incurved, rounded; midlobe reniform, emarginate, the margins lightly undulate; callus complex below the isthmus, fleshy, cruciform. Column 2-3 mm long, with a pair of broad, subquadrate, porrect wings or wings lacking (var. exauriculatum); anther terminal, much elongate; pollinia 2, with conspicuous, slender stipe ca. 3 mm long and viscidium. Capsules ellipsoid, with beak and persistent flower, 1.5-1.6 cm long; pedicel 8-10 mm long.

Epiphytic in open canopies, usually on larger branches, in premontane and lower montane forests at 600–1700 m. Flowering October to February (var. *cheirophorum*, mostly October to December; var. *exauriculatum*, mostly January and February). Reported from Mexico to Colombia.

This species is easily recognized out of flower by the pyriform pseudobulbs lightly stained with brown. The waxy yellow flowers with cruciform callus are distinctive when plants are in flower. We accept *O. exauriculatum*, based on the lack of conspicuous column wings, as a geographic variety of *O. cheirophorum*. Some herbarium specimens in Costa Rica show intermediate column wings. We note, however, that specimens from about central Costa Rica northward mostly lack the wings, occur at lower elevations (600–1450 m), and flower in late December to February, while *O. cheirophorum* occurs at 1000–1700 m and flowers from October to December and rarely in January. R. Jiménez Machorro reports that one in 10 flowers of Mexican var. *exauriculatum* produce fruits through self-pollination.

Oncidium cristagalli Rchb. f., Bot. Zeitung 10: 697. 1852. TYPE: Mexico, Oaxaca, *Galeotti 5289* (holotype: w, photo seen). *Oncidium decipiens* Lindl., Fol. Orch. *Oncidium* 22. 1855. TYPE: Mexico, Oaxaca, *Galeotti 5289*. Figure 37B.

Plant epiphytic, cespitose, 6-10 cm high. Rhizome short; roots 1 mm in diameter. Pseudobulbs ellipticovoid, compressed, 5-15 mm long, 5 mm wide, subtended by 5-8 foliaceous bracts; apex 1-foliate, or leaf aborted. Leaf thin, without articulation, linear-lanceolate, somewhat carinate beneath, 2-5 cm long, 6-12 mm wide. Inflorescence a lateral raceme of 3-4 somewhat successively borne flowers held just above the leaves; ovary with pedicel 4–8 mm long. Flowers 1.8–3 cm tall, 1.5-2.5 cm wide, yellow; petals and lip base spotted with brown. Sepals dissimilar; dorsal erect, concave, ovate, ca. 5 mm long, 3 mm wide; lateral sepals shortly connate, ca. 5 mm long, 2 mm wide. Petals similar to the dorsal sepal, ovate to subquadrate, 5–7 mm long, 4– 5 mm wide, acute. Lip deeply 3-lobate, 1.6-2 cm long, 1.4-1.7 cm wide, 5-7 mm across the isthmus, with somewhat crenulate margins; lateral lobes obovate 5-8 mm long, 3-5 mm wide; midlobe deeply emarginate, 4lobate; callus below the isthmus complex, with a more or less A-shaped, raised, bifid lamina in front. Column stout, ca. 4 mm long, with a conspicuous, broad pair of wings in front; anther shortly beaked; pollinia 2 supported on viscidium and oblanceolate stipe. Capsule elliptic-obovoid, ca. 1 cm long; pedicel 5 mm long.

Epiphytic in premontane rain forests, often on vines at 400–1100 m; reported to 1850 m. Flowering mostly July to January, but also sporadically throughout the year. Reported from Mexico to Peru.

The small plant with nonarticulate, nonequitant leaves and usually aborted leaf at the pseudobulb apex readily distinguishes this species in Costa Rica. It resembles *Psygmorchis pusilla* (L.) Dodson & Dressler in the flower and general habit, but the nonequitant leaves and the presence of a pseudobulb readily separate it from that species.

Plants from Costa Rica southward seem to have more strongly spotted petals than those from Mexico to Nicaragua.

Oncidium dichromaticum Rchb. f., Bonplandia 3:215. 1855. TYPE: New Granada(?), Booth (holotype: w, photo seen). Oncidium cabagrae Schltr., Repert. Spec. Nov. Regni Veg. 9:292. 1911. TYPE: Costa Rica, "Cabagra bei Buenos Aires," Pittier 6589 (drawing of type: AMES). Oncidium rechingerianum Kraenzl., Pflanzenr. IV, 50(Heft 80):202, t. 18. 1922. TYPE: Costa Rica, Endres (holotype: w; Photo of type: AMES). Oncidium castaneum Rchb. f. ex Kraenzl., Pflanzenr. IV, 50(Heft 80):278. 1922. TYPE: Costa Rica and Chiriquí, Endres (holotype: w, photo seen). Probably also Oncidium costaricense Schltr., Repert. Spec. Nov. Regni Veg. 9:30. 1910. TYPE: Terraba, 2600 m(?), Pittier 3859. Figure 39C.

Plant epiphytic, cespitose. Rhizome short; roots < 1mm in diameter. Pseudobulbs green spotted with dark wine-purple, somewhat laterally flattened, 7.5-12 cm long, 3.5-5.5 cm wide, ovoid to elliptic-oblong, subtended by 2-3 foliaceous sheaths, apically 2-foliate. Leaves oblanceolate, acute, with a prominent midvein, conduplicate at the base, 9-28 cm long, 1.4-3.5 cm wide. Inflorescence a lateral, slender, laxly flowered, short-branched panicle 30-80 cm long; ovary and pedicel 1.7-2.5 cm long, subtended by much shorter acute bracts. Flowers 1.8-3.3 cm high, 1.5-2.9 cm wide, colors basically of two patterns, yellow with brown markings or white with purple markings. Sepals subequal, 7-13 mm long, 4-8 mm wide, elliptic-oblong, the apex lightly recurved, apiculate; lateral sepals somewhat falcate. Petals similar to the sepals but larger, 1.2-2 cm long, 5-11 mm wide, margins undulate. Lip 3-lobate, pandurate, 1.5-2.3 cm long, 1.6-1.8 cm wide; lateral lobes small; midlobe deeply emarginate; callus at the base variable, usually of 4 teeth, 3 in front. Column 4-6 mm long, with dolabriform column wings at the apex, and with a conspicuous fleshy and smooth tabula infrastigmatica; pollinia 2, waxy, with stipe and viscidium. Capsules 4 cm long; pedicel 3 cm long.

Epiphytic on small to large branches in tropical evergreen forests at 500–1200 m of the Pacific slope. Often in disturbed forests. Flowering January to June. Costa Rica and Panama.

The variability of flower size and color in *O. dichromaticum* is extreme and at times confusing. Usually the flower is yellow with dense spots of dark brown on the sepals and petals as well as the lip, but rose forms may be frequent (var. *rosea* Hort.), and white flowers can be found. With experience it is recognized by the combination of the 2-foliate pseudobulbs, lax inflorescence, often

waving in the wind, and the dark sepals and petals.

Oncidium ensatum Lindl., Edwards's Bot. Reg. 28: misc. 17. 1842. Figure 39A. TYPE: Guatemala (not seen). Figure 40C.

Plant a robust, somewhat rhizomatous terrestrial to ca. 60 cm tall excluding the inflorescence. Rhizome short, ≤ 3 cm between pseudobulbs; roots 1–2 mm in diameter. Pseudobulbs ellipsoid, pale green, ca. 6-8 cm long, 2.3–3.5 cm wide, subtended by \geq 4 foliaceous sheaths lacking articulations, apically 2-foliate. Leaves and foliaceous bracts linear-ensiform, conduplicate, carinate, acuminate, nonarticulate, 25-40 cm long, 2.5-4 cm wide. Inflorescence lateral, paniculate, arcuate, 1-1.5 m long including the scape; primary branches 6–8 cm long; ovary and pedicel 1.8–2.5 cm long, subtended by a shorter floral bract 5-6 mm long. Flowers 2.3-2.8 cm in diameter, yellow, with reddish brown on the sepals, petals, and callus. **Sepals** similar, 1.3–1.5 cm long, 4-6 mm wide, acute; dorsal elliptic-oblong, margins undulate; lateral sepals somewhat larger, oblong, carinate. **Petals** similar to the sepals, oblique, elliptic-oblong, acute, 1.4–1.6 cm long, 3–5 mm wide, margins undulate. Lip 3-lobate, subpandurate, 1.2–1.5 cm long, 1.2–1.5 cm across the base, 1.2 cm across the midlobe; lateral lobes rounded, spreading, midlobe emarginate, apiculate, isthmus ca. 6-7 mm wide; callus fleshy, as wide or wider than long, with 7 teeth. Column short, 5 mm long, with undulate wings; pollinia 2, waxy.

Terrestrial on embankments in lowland, dry tropical, semideciduous forests at 450-850 m. Flowering March to April. Uncommon from Mexico to Panama.

The usually terrestrial plants with long, ensiform leaves lacking articulations (at least the foliaceous sheaths) and more or less typical flowers of the genus are good diagnostic features for field recognition.

Oncidium globuliferum Kunth, Nov. Gen. & Sp. 1:347. 1815. TYPE: New Granada, "Andium Popayanensium . . ," (?P). Oncidium globuliferum var. costaricense Rchb. f., Gard. Chron 1678. 1871. TYPE: Costa Rica, Endres (lectotype selected here: W13212). Oncidium wercklei Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:68. 1923. New name based on Endres (W 13212). Figure 37A.

Plant an epiphytic vine; apparent rhizome probably a modified, indeterminate inflorescence, with lateral shoots spaced 6–10 cm or more apart. Pseudobulbs of lateral shoots suborbicular to elliptic-ovoid, strongly compressed; 1.5–3 cm long, 1.3–2.5 cm wide, subtended by 1–3 foliaceous sheaths; apex 1-foliate. Leaves elliptic-ovate, abaxially carinate, the apical leaf with short

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petiole, 5-8 cm long, 1.5-2.5 cm wide; apex acute to obtuse; foliaceous sheaths smaller. Functional inflorescence formed in 2 ways, directly on rhizome, with or without an accompanying new shoot, or within a foliaceous sheath at the pseudobulb base; a solitary flower; scapes to about 3 cm long (excluding flower and pedicel); ovary with pedicel 2.5-4.5 cm long, subtended by subulate bract 3-6 mm long. Flower large, 2.5-4 cm tall, 2-3 cm wide, brilliant yellow with tepals spotted with brown. Sepals dissimilar, shortly unguiculate; dorsal elliptic, acute, apiculate, 1.2-1.5 cm long, 6-7 mm wide; lateral sepals reflexed, oblong-elliptic, acute, 1.3-1.6 cm, 5-6 mm wide. Petals oblong-ovate, somewhat constricted centrally, shortly unguiculate, 1.4-1.6 cm long, 5-6 mm wide; margins undulate; apex acute to obtuse. Lip strongly 3-lobate, 2-3 cm long, 2.5-3.5 cm wide (midlobe), ca. 1 cm across lateral lobes; isthmus 5-6 mm wide; midlobe deeply emarginate, forming 2 rounded lobes; callus fleshy, with 7-9 teeth. Column erect, 8 mm long, with broad wings; anther papillose, pollinia 2, with short stipe and viscidium.

Epiphytic in high canopies of premontane and montane rain forests at 800–1800 m. Flowering only in the brightest part of the canopy January to August. Costa Rica to Ecuador; probably also to Venezuela and perhaps to Bolivia.

The viny habit of *O. globuliferum* is unique to this species, especially since the "rhizome" appears to be a modified inflorescence that produces short vegetative shoots laterally. Nothing is known about the base of the plant.

Reichenbach attempted to recognize the Costa Rican plants with consistently smaller flowers as var. *costaricense*, but specimens from Ecuador exhibit flowers of similar size.

Oncidium isthmi Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:84. 1922. TYPE: Panama, Sambo River, South Darien, 200 m, *Pittier 5569* (drawing of type: AMES). Figure 41B.

Plant a robust, somewhat rhizomatous epiphyte to about 75 cm excluding inflorescence; rhizome short to about 5 cm between pseudobulbs; roots 1-2 mm in diameter, some of them directed upward (trash-basket roots). Pseudobulbs large, 9-15 cm long, 3-4.5 cm wide, sulcate, oblong-ovoid, apically 2-3-foliate, covered at the base by 2-4 foliaceous bracts. Leaves coriaceous, linear-ligulate, acute, 25-35 (60) cm long, (2)4-5 cm wide; apex acute. Inflorescence lateral, paniculate, arcuate or pendulous, to 1.50 m long including the scape, primary branches 8-15 cm long; ovary and pedicel 1.8–2.5 cm long, subtended by bracts 5–6 mm long. Flowers 2.3-2.8 cm long, 1.8-2.5 cm wide, yellow, barred with reddish brown on the sepals, petals, and callus. Sepals dissimilar; dorsal elliptic-oblong, acute, with undulate margins, 11-12 mm long, 5-7 mm wide; lateral sepals somewhat larger, oblong, acute, 1.2-1.5 cm long, 4–7 mm wide. **Petals** elliptic-oblong, oblique, subacute, with undulate margins, 1.1–1.3 cm long, 4–5 mm wide. **Lip** 3-lobate, pandurate, 1.4–1.7 cm long, 9–11 mm across the base, 1.4–2 cm across midlobe; lateral lobes, rounded, extended laterally; midlobe emarginate, apiculate; isthmus narrow, ca. 4 mm wide with strongly recurved margins; callus fleshy, as wide or wider than broad, with 7 teeth. **Column** short, 5 mm long, with serrate, dolabriform wings; pollinia 2, waxy, pyriform, with stipe and viscidium.

Epiphytic on larger branches in lowland tropical semideciduous forests at 450–850 m. Flowering December to April. Southeastern Costa Rica and Panama.

Oncidium isthmi is most similar to O. polycladium Rchb. f. ex Lindl. but has longer primary branches in the inflorescence, and the flowers are a more intense yellow. Also, the midlobe of the lip is much larger with, consequently, a more conspicuously narrow isthmus.

Oncidium klotzschianum Rchb. f., Bot. Zeitung (Berlin) 10:695. 1852. TYPE: Chiriquí, Warscewicz (W). Oncidium obryzatum Rchb. f., Bonplandia 2:108-109. 1854. TYPE: Peru, Warscewicz (?holotype: w, photo seen). Oncidium fulgens Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:83. 1922. TYPE: Panama, Chiriquí, Powell 157 (lectotype selected here: AMES 23918). Oncidium angustisepalum Kraenzl., Pflanzenr. IV. 50(Heft 80):203. 1922. TYPE: Costa Rica, *Endres* (holotype: w, photo seen). ?Oncidium sclerophyllum Kraenzl., Pflanzenr. IV. 50(Heft 80):204. 1922. TYPE: Costa Rica, San Ramón, Endres (W). Oncidium varians Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 151. 1923. TYPE: Costa Rica, La Palma, A. & C. Brade 1095. Oncidium graciliforme C. Schweinf., Bot. Mus. Leafl. 5:96-97. TYPE: Panama, Chiriquí, Powell 3227 (Hort. Powell 157). Figure 39B.

Plant epiphytic, cespitose, forming small clumps to 40 cm tall excluding inflorescence. Rhizome short; roots 0.5–1.5 mm in diameter. **Pseudobulbs** smooth to rugose, usually with purple spots, suborbicular to conic, suffused and marked with dark brown, 3-8.5 cm long, 1.2-4 cm wide, subtended by 3-5 foliaceous bracts, apex 1(2)foliate. Leaf base conduplicate; blade carinate beneath, linear-lanceolate to broadly elliptic, coriaceous, 10-35 cm long, 1.2-6 cm wide, apex acute or subacute. Inflorescence an erect or arcuate raceme (when small) or panicle 30-80 cm long including the scape with numerous flowers; ovary and pedicel 1.1-2.5 cm long. Flowers variable in size, 2-4 cm high, 1-3.2 cm wide, yellow, segments marked basally with brown. Sepals subequal, free, obovate-spatulate, obtuse or truncate, carinate abaxially, 9-15 mm long, 2-7 mm wide. Petals broader than sepals, obovate-spatulate, obtuse or truncate, 1–1.5 cm long, 4–12 mm wide. **Lip** 3-lobate, 1–2.5 cm long, 1–2.5 cm wide, midlobe deeply emarginate; isthmus 2–5 mm wide; lateral lobes rounded; callus basal, fleshy, the basal part forming a plate with 4–5 small teeth at the base and 3 larger teeth in the front. **Column** 5–6 mm long, with a pair of apical, porrect, dolabriform wings with serrulate margins; tabula infrastigmatica with 2 fleshy projections; anther beaked; pollinia 2, waxy, rounded, with elongate stipe and viscidium. **Capsules** (only 1 specimen in fruit seen) ellipsoid, ca. 3 cm long with beak; pedicel about 1 cm long.

Common epiphyte in premontane and lower montane rain and cloud forests at 700–1900 m. Flowering throughout the year. Costa Rica to Peru.

The small-flowered forms of *O. klotzschianum* may be distinguished from *O. obryzatoides* Kraenzl. by the larger, paniculate inflorescences and by the color of the tepals, which are spotted with brown rather than stained along the midveins.

The bewildering range in flower size and plant form seems to indicate either extreme variation with expected proliferation of synonyms, or that there are several closely related species here. There appears to be no pattern of size variation according to either horizontal or vertical ranges, nor of phenology. Indeed, marked differences in flower size can be seen in the same herbarium specimen. Of all the synonyms proposed above, only O. obryzatum corresponds to the large-flowered forms. The smallest-flowered extremes are represented by the names O. sclerophyllum and O. graciliforme. In the Manual (MO) treatment, Dressler is accepting O. sclerophyllum as distinct, although it is known only by the type specimen. A rehydrated flower from the type had broad, spatulate sepals in addition to the petals, but the callus and column were consistent with O. klotschianum.

The plant accepted in Dunsterville and Garay (*Venezuelan Orchids Illustrated* 6, p. 303) as *O. klotzschianum* exhibits a repent habit, smaller lip in proportion to the tepals, and shorter column wings, features that do not agree with the type from Panama. The illustrated plant may be *O. picturatum* Rchb. f., described from Venezuela but not treated in the six-volume work.

Oncidium luteum Rolfe, Bull. Misc. Inform. 172. 1893. Type locality unknown. *Oncidium pittieri* Schltr., Repert. Spec. Nov. Regni Veg. 9:30. 1910. TYPE: Costa Rica, by La Palma, *Pittier 10310* (drawing of type: AMES, photo seen). *Oncidium cheirophoroides* Kraenzl., Pflanzenr. 80:

199, t. 1922. TYPE: Costa Rica, *Endres* (holotype: w, photo seen). Figure 38B.

Plant a stout, cespitose epiphyte 10-35 cm tall excluding inflorescence. Rhizome short; roots ≤ 2 mm in diameter. **Pseudobulb** nearly obsolete, compressed, ≤ 4 cm long, subtended and concealed by 4-6 foliaceous sheaths, apex 1-foliate. Leaves arranged in a fan, duplicate, subcoriaceous, narrowly to broadly elliptic, acute, with conspicuous sheath below the articulation, 6-30 cm long, 1.5-6.5 cm wide. Inflorescences 1-2 in the foliaceous sheath axils, mostly less than twice the longest leaf, each a panicle with 1-2 or more orders of branching, 15-55 cm tall including the scape; branches fractiflex; ovary with pedicel ca. 1 cm long, subtended by small triangular bracts ≤ 2 mm long. Flowers greenish yellow, with brown spot near callus. Sepals similar, somewhat concave, oblanceolate-obovate, obtuse, 3-5 mm long, 2-3 mm wide; lateral sepals somewhat reflexed at the base. Petals broadly elliptic, obtuse, 4-5 mm long, 2-3 mm wide. Lip deeply 3-lobate near the base, about 9-14 mm long, 1-1.2 cm wide; lateral lobes winglike, suborbicular; midlobe broadly cuneate, 4-5 mm wide; isthmus ca. 2 mm wide; callus below the isthmus of 2 lateral and 3 central teeth. Column complex and unusual, with a central horn at the base curved upward, with a pair of antrorse hornlike wings at the apex; anther with conspicuous beak; pollinia 2, with long stipe about 2 mm long. Capsules ellipsoid, 1.6 cm long including the long beak; pedicel 5-7 mm long.

Epiphytic in windy cloud forests at 1200–2500 m. Flowering October to December. Endemic to Costa Rica.

This rare epiphyte is easily distinguished by the large fan of leaves concealing the pseudobulb. Flowers could be confused with those of *O. cheirophorum* Rchb. f., but the plants are much larger with much broader and longer leaves subtending the nearly obsolete pseudobulb.

Oncidium obryzatoides Kraenzl., Pflanzenr. IV. 50(Heft 80):240. 1922. TYPE: Costa Rica, Endres (w). Oncidium tetraskelidion Kraenzl., Pflanzenr. IV. 50(Heft 80):259. 1922. Oncidium brenesii Schltr., Repert. Spec. Nov. Regni Veg. 19:257–258. 1923. TYPE: Costa Rica, Brenes 240 (AMES). *Oncidium calyptostalix Kraenzl., Pflanzenr. IV. 50(Heft 80):260. 1922. TYPE: Costa Rica, Endres (w, photo seen). Figure 39A.

Plant a small cespitose epiphyte to 8–25 cm tall; rhizome short; roots to 1.5 mm in diameter. Pseudobulbs often with purplish spots, ovoid, sulcate, somewhat compressed laterally, 2.5–5 cm long, 2–3 cm wide; subtended by 2–4 foliaceous bracts; apex 1-foliate. Leaves usually distinctly petiolate; blade subcoriaceous, carinate beneath, elliptic-lanceolate, 5–25 cm long, 1–3 cm wide; apex acute, apiculate. Inflorescence a lateral raceme or

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few-branched panicle, 12-35 cm long; ovary with pedicel 1.7-2.5 cm long. Flowers variable, 1.5-3 cm high, greenish yellow; tepals stained with brown along midvein; lip brown around the callus. Sepals similar, shortly unguiculate, obovate to spatulate, 10-12 mm long, 4-5 mm wide; apex obtuse to rounded, apiculate, carinate abaxially; lateral sepals sometimes reflexed. Petals similar to the sepals, somewhat constricted centrally, 10–12 mm long, 5-6 mm wide; apex obtuse to rounded, apiculate. Lip deeply 3-lobate at the base, 10-17 mm long, 6–16 mm across the subtriangular lateral lobes; midlobe deeply emarginate, forming an isthmus 3–5 mm wide; callus fleshy between lateral lobes, with broad projection centrally, 2 blunt lateral teeth centrally, 2 similar teeth in front. Column complex, 8 mm long; tabula infrastigmatica with prominent lateral margins, apical wings subtriangular with crenulate margins; pollinia 2, round, supported on an oblanceolate stipe and viscidium. Capsules ellipsoid, ca. 4 cm long including elongate beak; pedicel 2–2.5 cm long.

Epiphytic on larger branches of cloud forests at 1050–1900 m. Flowering September to February. Endemic to Costa Rica from the south side of the Central Valley to the Monteverde area.

Oncidium obryzatoides is distinguished by the inflorescence, which has few branches, each with few greenish yellow flowers with centrally brownstained tepals. The similar O. klotzschianum Rchb. f. has tepals distinctly spotted with brown and often larger, deeper-yellow flowers. Hybrids possibly exist between the two species.

Oncidium fulgens Schltr. and O. varians Schltr. have been considered as synonyms of O. obryzatoides (Bot. Mus. Leafl. 6:6-7. 1938), and their types have similarly small flowers. However, the types of O. fulgens and O. varians have broader brown-spotted petals consistent with small forms of O. klotzschianum Rchb. f. (synonym, O. obryzatum Rchb. f.) rather than the narrower petals stained with brown along the midvein as in O. obryzatoides.

Oncidium ochmatochilum Rchb. f., Bot. Zeitung (Berlin) 10:698. 1852. TYPE: Probably Chiriquí, Panama, Warscewicz s.n. (w). ?Oncidium chelidon Kraenzl., Pflanzenr. IV. 50(Heft 80): 216–217. 1922. TYPE: Locality unknown, Wallis. Oncidium chelidonizon Kraenzl., Pflanzenr. IV. 50(Heft 80):217. 1922. TYPE: Costa Rica, Endres s.n. (w).

Plant a large, cespitose epiphyte to nearly 1 m without inflorescence; rhizome short, roots 2–4 mm in diameter. **Pseudobulbs** little compressed laterally, rugose, ovoid to lanceolate, 10–15 cm long, 3.5–5 cm wide; subtended by 6–10 foliaceous sheaths; apex usually 2(rarely 1)-foliate, somewhat attenuate. **Leaves** conduplicate at the base, the blade linear-ensiform, with raised

veins abaxially, 40-60 cm long, 3-5 cm wide; apex acute. Inflorescence lateral, paniculate, to about 3 m long including the scape; branches fractiflex; ovary with pedicel, 3-4 cm long, subtended by a short, triangular bracts ca. 2 mm long. Flowers with tepals greenish with reddish brown spots, apices greenish; lip white with yellow callus, with an orange spot at the base and purple spots at and below the isthmus. Sepals similar, free, reflexed, abaxially carinate, linear-lanceolate, 1.5-1.6 cm long, 3-4 mm wide; apices acute, apiculate; lateral sepals reflexed. Petals reflexed, elliptic ovate to lanceolate, carinate abaxially, 1.3-1.5 cm long, 5-7 mm wide; apex acute, apiculate; margins undulate. Lip 3-lobate, 1.2-1.4 cm long, 1-1.2 cm wide; lateral lobes rounded, ca. 5 mm long, 3 mm wide; midlobe anchor-shaped, apiculate, not undulate; isthmus ca. 5 mm wide; callus on lower half, fleshy, with 7 teeth, 4 teeth laterally and 3 apically. Column stout, 6 mm long, with conspicuous tabula infrastigmatica, without wings; pollinia 2, supported on an elongate stipe and viscidium.

Low-density epiphyte in evergreen forests on larger branches at 800–1400 m; usually seen as single plants. Flowering April to August. Costa Rica and Panama; reported from Guatemala to Nicaragua and Andean South America.

Oncidium ochmatochilum is easily distinguished by the growth habit, with several long leaves subtending the pseudobulbs, and the long inflorescence sometimes exceeding 2 m. Vegetatively, it is similar to O. panduriforme Ames & C. Schweinf., a species with shorter inflorescences and somewhat smaller, less complex flowers.

Oncidium cardiochilum Lindl. (1855) may be the South American equivalent of O. ochmatochilum.

Oncidium panduriforme Ames & C. Schweinf., Sched. Orch. 8:77–78. 1925. TYPE: Costa Rica, Cachi, *Alfaro* (holotype: Us, photo seen). Figure 36C.

Plant epiphytic, cespitose, forming small clumps to about 50 cm excluding inflorescence. Rhizome short; roots flexuous, 3-4 mm in diameter. Pseudobulbs ovoid, 6-10 cm long, 3-5 cm wide, apically 1-2-foliate, concealed when young by 6-8 foliaceous sheaths. Leaves elliptic-lanceolate, acute, coriaceous, with raised veins abaxially, base conduplicate, 10-40 cm long, 3-5 cm wide. Inflorescence lateral, paniculate 40-80 cm long including the scape, arcuate, branches short, fractiflex; ovary and pedicel 1.5-2.5 cm long. Flowers 2-2.2 cm long, 1.7-1.9 cm wide; tepals yellowish lightly spotted with brown; lip white turning yellow. Sepals subequal, elliptic-lanceolate, acuminate, abaxially carinate, 10-12 mm long, 3-4 mm wide; dorsal erect; lateral sepals lightly falcate and reflexed. Petals similar to the sepals but broader, 10–12 mm long, 3.4–4.5 mm wide. Lip pandurate, 3-lobate, 10-12 mm long, 8-9 mm wide, isthmus broad, about 5-6 mm wide; lateral lobes small, subquadrate; midlobe reniform, emarginate, apiculate; disk with a fleshy, obscurely 3-dentate, platelike callus basally. **Column** erect, without wings, 6–8 mm long; tabula infrastigmatica with 2 fleshy, elevated, antrorse borders; pollinia 2, waxy, rounded, with conspicuous stipe and viscidium.

Rare epiphyte of high canopies of premontane and lower montane cloud forests at 1400–1800 (2500) m. Flowering July to November. Costa Rica; also reported from Panama.

Oncidium panduriforme is nearly identical in habit to O. ochmatochilum Rchb. f., a species with somewhat larger pseudobulbs, longer inflorescences, and larger, more complex flowers.

Oncidium parviflorum L. O. Williams, Amer. Orchid Soc. Bull. 11:32–33. 1942. TYPE: Panama, Province of Coclé, region north of El Valle de Antón, *Allen 2937* (AMES). Figure 39D.

Plant a cespitose epiphyte to about 40 cm tall; rhizome short; roots ≤ 2 mm in diameter. Pseudobulbs spotted with purple, elliptic to ovoid, compressed, sulcate, 8-12 cm long, 3-4 cm wide, subtended by 3-4 foliaceous bracts; apex 1-foliate. Leaves petiolate; blades coriaceous, carinate beneath, linear lanceolate, 15-40 cm long, 2-3 cm wide; apex acute, somewhat asymmetric. Inflorescence lateral, paniculate, 75-100 em long, with short, compact, fractiflex primary branches 1-2 cm long; ovary with pedicel ca. 6 mm long, subtended by a subulate bract 3-4 mm long. Flowers spreading, 1.3-1.5 cm tall; tepals brown with yellow apices; lip with yellow lobes, area around callus and isthmus brown. Sepals dissimilar, distinctly unguiculate, with undulate margins; dorsal obovate to spatulate, somewhat keeled abaxially 5-6 mm long, 2-3 mm wide, obtuse, apiculate; lateral sepals elliptic, falcate, with prominent keel abaxially, 6-7 mm long, 2-3 mm wide, acute. Petals similar to the dorsal sepal, unguiculate, spatulate, 5-6 mm long, 3-4 mm wide; apex acute to obtuse, apiculate. Lip 3-lobate from the base, 9-12 mm long, 6–7 mm wide across lateral lobes, 4–5 mm across midlobe; lateral lobes rounded; midlobe deeply emarginate; isthmus ca. 3 mm wide; callus between lateral lobes fleshy, minutely pubescent, with 2 lateral and 2 apical teeth. Column 2-3 mm long, with a pair of rounded, porrect, acute column wings; anther with short beak; pollinia 2, obovoid, with viscidium and elongate stipe. Capsules unknown.

Epiphytic and apparently rare in premontane rain forests at 800–1000 m. Flowering in Costa Rica May and June; in Panama, February and March. Northern Costa Rica to Central Panama.

Oncidium parviflorum is easily recognized by the purple-spotted pseudobulbs, elongate inflorescence with very short branches, and the small flowers.

Flowers of Costa Rican plants differ somewhat from the type in the more slender lateral sepals,

the broader midlobe, and the markedly less pubescent callus. Otherwise, the plant habit, with long, slender inflorescence, the color pattern of the flowers, and the large, semilunate column wings provide a very good match for *O. parviflorum*. The above description is based on Costa Rican material.

Oncidium polycladium Rchb. f. ex Lindl., Fol. Orch. 6(7):47. 1855. TYPE: Costa Rica (probably Panama in modern times), Veragua Chiriquí, Warscewicz (holotype: κ; isotype: w). Probably Oncidium guttulatum Rchb. f. ex Lindl. TYPE: Locality unknown, from garden at Herrenhausen (κ). Oncidium tonduzii Schltr., Repert. Spec. Nov. Regni Veg. 9:31. 1910. TYPE: Costa Rica, Santo Domingo de Golfe Dulce, A. Tonduz 9891 (isotype: US; drawing of type: AMES). ?Oncidium peliograma Linden & Rchb. f., Gard. Chron. 1451. 1871. TYPE: Chiriquí, Wallis. Figure 41A.

Plant epiphytic, cespitose to ca. 50 cm high; rhizome short; roots ≤ 2.5 mm in diameter. Pseudobulbs ovate, sulcate, compressed, 7-15 cm long, 1.5-4 cm wide; apex (1)2-3-foliate, subtended by 5-6 foliaceous, soon deciduous bracts. Leaves subcoriaceous, abaxially carinate, 35-50 cm long, 1.5-6 cm wide, base conduplicate, apex acute. Inflorescence paniculate, ≤ 1 m long including scape; primary branches somewhat fractiflex, 2-12 cm long; ovary with pedicel 1.5-2 cm long subtended by a subulate bract about 7 mm long. Flowers 2-2.7 cm high, yellow, bases of tepals and lip with brown bands. Sepals dissimilar, distinctly unguiculate, with undulate margins; dorsal obovate to ovate, obtuse, apiculate, 9-11 mm long, 4 mm wide; lateral sepals elliptic-oblong, falcate, 11-13 mm long; 3-4 mm wide. Petals shortly unguiculate, elliptic to subspatulate, 8-10 mm long, 4-5 mm wide; margins undulate; apex obtuse. Lip 3-lobate from the base, 9-13 mm long, 6-8 mm wide across the base, 8–13 mm wide across midlobe; lateral lobes small, rounded; midlobe reniform, emarginate; isthmus 3-4 mm wide when spread; callus fleshy, narrower than long, with about 7 rounded teeth, 3 apical and 4 lateral, the central tooth largest and obliquely truncate. Column 4-5 mm long; tabula infrastigmatica with enlarged lateral margins; column wings dolabriform; anther without beak; pollinia 2, with stipe and viscidium. Capsules ellipsoid, 5 cm long including short beak; pedicel 1 cm.

Epiphytic usually in crotches between larger branches of trees in semideciduous forests at 0–1000 m on the Pacific slope. Flowering late January to April. Costa Rica and probably Panama.

Oncidium polycladium has been synonymized with related O. baueri Lindl. from South America. However, that species has a more sharply toothed callus, narrower column wings, and a distinctly beaked anther. It is easily distinguished from O.

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isthmi Schltr. only with experience. In aspect, the isthmus of *O. isthmi* is comparatively much narrower, and the branches of the inflorescence are statistically longer.

The original description of *O. guttulatum* mentions neither origin nor collector, but a recent analysis of the flower shows the characteristic lip that is longer than the lateral sepals and the callus of *O. polycladium*.

Oncidium schroederianum (O'Brien) Garay & Stacey, Bradea 1:408. 1974. Odontoglossum schroederianum Rchb. f., nom. illeg. (not Rchb. f. 1882), Gard. Chron. 3,2:364. 1887. TYPE: Schroeder (holotype: W, photo seen). Miltonia schroederiana O'Brien, Gard. Chron. (2):210. 1889. Odontoglossum confusum Garay (nom. nov.), Orchidee (Hamburg) 13:217. 1962. Miltonioides confusa (Garay) Brieger & Lückel, Orchidee (Hamburg) 34(4):131. 1983. Figure 35E.

Plant epiphytic, cespitose, Rhizome short; roots 2 mm in diameter. Pseudobulbs elliptic-oblong, coarsely sulcate, 5.5-10 cm long, 2-4 cm wide, apically 1-3-foliate, subtended when young by 4-6 foliaceous bracts. Leaves subcoriaceous, abaxially carinate, conduplicate at the base, acute, 10-40 cm long, 2.5-5 cm wide. Inflorescence a several-flowered raceme, rarely a panicle with 1-2 branches, erect or arcuate, 20-30 cm long including the scape; ovary and pedicel 2.5-3 cm long subtended by a much shorter, triangular bract. Flowers 5-6.3 cm tall, 2.8-3.3 cm wide; tepals yellowish barred with chocolate brown, yellow-tipped; lip white turning yellow with age, tinted rose basally. Sepals free, similar, linearlanceolate, acuminate; dorsal 2.5-3.2 cm long, 5-8 mm wide; lateral sepals lightly inflexed, 3.2–3.7 cm long, 5– 8 mm wide. Petals falcate, acuminate, curved upward, 2.2-3.2 cm long, 9-12 mm wide. **Lip** simple, 2.8-3.2cm long, 2.4-2.6 cm wide, united firmly to the column base, with a single broadened reniform apical lobe; disk with a fleshy elevated callus of 3 keels, the middle keel bifid apically. Column short, 9 mm long, with fleshy tabula infrastigmatica; pollinia 2, with stipe and conspicuous viscidium.

Epiphytic in premontane cloud forests at 900–1800 m. Flowering July to October. Costa Rica and Panama.

Oncidium schroederianum is easily recognized by the chocolate-barred tepals and large, simple, white lip stained with rose at the base.

Oncidium stenobulbon Kraenzl., Pflanzenr. IV.
 50(Heft 80):281. 1922. TYPE: Costa Rica, Endres (holotype: w, photo seen). Oncidium naranjense Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:259. 1923. TYPE: Costa Rica, Cerro

del Espiritu Santo a Naranjo de Alajuela, *Brenes* 22 (lectotype selected here: AMES). Figure 40B.

Plant cespitose, epiphytic, yellowish green. Rhizome short; roots white, 1-2 mm in diameter. Pseudobulbs elliptic-ovoid to suborbicular, strongly flattened laterally, 3.5-12 cm long, 3.5-5 cm wide, furrowed when dry, the base covered by 2-4 imbricate, foliaceous bracts. Leaves sessile to short petiolate, strongly carinate abaxially, 1-2(3) at the pseudobulb apex; blade elliptic to obovate, obtuse, coriaceous, conduplicate at the base, 4-15 cm long, 2.5–5.5 cm wide. Inflorescences lateral, 1– 2 at the base of the shoot, an erect or arcuate panicle, exceeding the leaves, 50-80 cm long; branches zigzag, 2-10 cm long, with 1-5 flowers; ovary with pedicel 1.5-2.5 cm long. Flowers yellow, 2.5-3 cm in diameter; tepals spotted with light brown, apices yellow; lip yellow with brown on isthmus. Sepals dissimilar, free with undulate margins, elliptic-ovate, with claw at the base; dorsal erect, 1.1-1.2 mm long, 1-2 mm wide; lateral sepals reflexed with longer claw, subfalcate, 1.4-1.5 cm long, 2-3 mm wide. Petals broader than the sepals, with short claw, elliptic-ovate to lanceolate, 1-1.2 cm long, 5-6 mm wide. Lip 3-lobate, 1.4-1.7 cm long, 1-1.5 cm wide; lateral lobes, rounded, 5-7 mm long, 4-5 mm wide; midlobe emarginate, apiculate, with undulate margin; isthmus ca. 5 mm wide; callus fleshy, consisting of 7 teeth, 5 in one plane, 2 lower at the apex. Column short, 5-6 mm long, with tabula infrastigmatica; column wings somewhat rounded, the margins entire; pollinia 2, obovate, with prominent stipe and viscidium.

Uncommon epiphyte in deciduous forests at 800-1050 m elev. Flowering November to December; April and June. Apparently endemic to Costa Rica

Oncidium stenobulbon closely resembles O. ansiferum Rchb. f., a species with plants less yellow-green, usually more elongate leaves, hatchet-shaped column wings, and, most notably, nearly solid, dark brown tepals. Oncidium ansiferum is known mostly above 1350 m. See additional notes under that species.

Oncidium stenoglossum (Schltr.) Dressler & N. H. Williams, Orquídea (Méx.) 4:339. 1975. Miltonia stenoglossa Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:66. 1923. TYPE: Costa Rica, Tonduz 31. Odontoglossum stenoglossum (Schltr.) L. O. Williams, Lloydia 10:212. 1947. Miltonioides stenoglossa (Schltr.) Brieger & Lückel, Orchidee (Hamburg) 34:131. 1983. Figure 36B.

Plant a cespitose epiphyte; rhizome short; roots to 2 mm in diameter. Pseudobulbs ovate, sulcate, 5–9 cm long, 2.5–3.5 cm wide; subtended by 3–4 foliaceous bracts; apex 1–2 foliate. Leaves coriaceous, condupli-

cate, elliptic to oblong, 15-35 cm long, 2.2-3.3 cm wide; apex bluntly acute, apiculate. Inflorescence lateral, arcuate, paniculate (Costa Rican plants), 50-80 cm long, laxly flowered; scape with short bracts and conspicuous nodes; primary branches 6-15 cm long; ovary with pedicel 1-2 cm long, subtended by triangular ovate bracts 4-6 mm long. Flowers with tepals yellowish barred with dark green to brown; lip white turning yellow, with purple band(s) on lower 3. Sepals similar, elliptic oblanceolate, 1.5-1.9 cm long, 5-7 mm wide; apex carinate abaxially, acute; lateral sepals close forming an acute angle. Petals similar to the sepals, oblanceolate, subfalcate, curved upward, 1.6-2 cm, 5-6 mm wide; apex recurved, acute. Lip simple, 1.6-1.7 cm long, 5-7 mm wide; base canaliculate clasping the column; apex dilated, fleshy, abaxially carinate; callus essentially absent, base with obscurely thickened nerves. Column stout, 4 mm long; with narrow, undulate wings; pollinia 2, with elongate stipe and viscidium. Capsules ellipsoid, 2 cm long, pedicel 1 cm long.

Epiphytic on larger branches in humid, shady, cloud forests at 1400–2000 m. Flowering May to December. Costa Rica and Panama; also reported from Mexico to Nicaragua, but may be confused with other species. Plants in cultivation often produce fruit, suggesting autogamy, which might explain differences seen in different regions.

We are fortunate that the basionym *Miltonia* stenoglossa Schltr. is Costa Rican, because we cannot verify heterotypic synonyms suggested by others. The basionym *Odontoglossum leucomelas* Rchb. f. (1864) from Mexico is much more strongly colored, but is otherwise similar to the Costa Rican plant. The basionym *Odontoglossum pauciflorum* L. O. Williams (1954) is probably synonymous, although the type is from Honduras.

Oncidium stenotis Rchb. f., Linnaea 41:67. 1877. TYPE: Costa Rica, Low (holotype: w, photo seen). Oncidium turialbae Schltr., Repert. Spec. Nov. 9:32. 1911. TYPE: Costa Rica, Turialba, Biolley (or Pittier?) 8423 (drawing of type: AMES; ?isotype: Pittier 8423, US). Figure 40D.

Plant epiphytic, somewhat climbing; rhizome distinct; roots much branched, 1–2 mm in diameter. Pseudobulbs elliptic oblong, 8–15 cm long, 3–5 cm wide, somewhat compressed laterally, ancipitous, coarsely sulcate, subtended by 3–6 foliaceous bracts, apex 1-foliate. Leaves petiolate, elliptic-oblong, subcoriaccous, base conduplicate, strongly carinate abaxially, 20–60 cm long, 2–6 cm wide, apex obtuse to rounded, apiculate. Inflorescence lateral, paniculate, 1–1.5 m long with primary branches ≤ 12 cm long; ovary with pedicel 2.5–4 cm long. Flowers numerous, 2–3.5 cm in diameter, usually dull yellow spotted with brown, lip bright yellow marked at and below the isthmus with brown. Sepals

free, elliptic-lanceolate, apiculate, the margins crenulate; dorsal 1.3–1.7 cm long, 5–7 mm wide; lateral sepals unguiculate, strongly carinate abaxially, 1.7–2.2 cm long, 4–7 mm wide. **Petals** similar to dorsal sepal, parallel with lateral sepals, elliptic-lanceolate, 1.3–1.7 cm long, 5–7 mm wide, margins crenulate; apex falcate, apiculate. **Lip** 3-lobate, 1.3–1.6 cm long and wide; lateral lobes suborbicular; midlobe reniform, emarginate, apiculate, margins undulate; isthmus 3–4 mm wide, less than ½ the width of the lip; callus fleshy, with 4–6 teeth at the base and 3 at the apex. **Column** 5–7 mm long, with tabula infrastigmatica, with a pair of narrow, dentate, apical wings; pollinia 2, with elongate stipe and viscidium.

Epiphytic in lowland and premontane rain forests of the Atlantic slope at 50–1300 m. Flowering mostly September to December; rarely to April. Reported from Honduras to Ecuador; perhaps also Peru.

Oncidium stenotis is distinguished by the broad apical leaf on relatively large, sulcate pseudobulbs, the elongate inflorescence with relatively short primary branches, and the relatively large flowers with suborbicular lateral lobes. In plant habit it much resembles O. powellii Schltr. from Panama, a species with much larger flowers with nearly solid brown sepals and petals.

Oncidium storkii Ames & C. Schweinf., Sched. Orch. 10:106. 1930. TYPE: Costa Rica, Santa Maria de Dota, *Lankester 1244* (holotype: AMES). Figure 36D.

Plant epiphytic, cespitose. Rhizome short; roots to 2 mm in diameter. **Pseudobulbs** pyriform, somewhat compressed, sulcate, 3-6 cm long, 2.5-4 cm wide, subtended by 2-4 foliaceous bracts, apically 2-3-foliate. Leaves coriaceous, elliptic-lanceolate, the larger 18–30 cm long, 2–3 cm wide, conduplicate at the base forming a short petiole, apically bluntly acute, 2-lobate. Inflorescence a lateral panicle, erect, 25-45 cm long including scape; primary branches 3 or more, recurved, secund 4-6 cm long, subtended by cymbiform bract, 3–3.5 cm long, to about 1 cm broad when spread; ovary and pedicel 1-2 cm long, subtended by triangular bracts 1.4-2 cm long. Flowers 3-8 per branch, 1.7-2 cm high, 1.3-1.5 cm broad, tepals green, unspotted, lip cream turning yellow, isthmus orange. Sepals dissimilar; dorsal erect, obovate, margins undulate, 7.5–9 mm long, 4–6 mm wide apiculate; lateral sepals shortly connate, lanceolate, carinate abaxially, 10-12 mm long, 4-5 mm wide. Petals oblong-ovate, obtuse to rounded, 7.5-9.5 mm long, 5-6 mm wide. Lip sessile, pandurate, 12-14 mm long, 7-9 mm wide; lateral lobes subquadrate; midlobe 1.3-1.5 cm wide, reniform, emarginate, and apiculate, forming a narrow isthmus at the base; callus at the base fleshy, elevated without apparent teeth. Column stout, 4–5 mm long, erect, with fleshy tabula infrastigmatica, apex with 2 porrect wings; pollinia 2, waxy, with prominent stipe and viscidium.

Rare epiphyte of premontane and montane cloud forests at 1150–1800 m. Flowering January to May. Endemic to Costa Rica and known only in the southern Central Valley.

Oncidium storkii is characterized by the unusual inflorescence structure, which consists of a panicle of secund racemes, each with several green and yellow, unspotted flowers. Oncidium bracteatum, also with similar large inflorescence bracts, has yellow flowers with tepals spotted with dark brown. Also, the lip is deep yellow with dark brown around the isthmus, and there are more pronounced lateral lobes in that species.

Oncidium teres Ames & C. Schweinf., Sched. Orch. 8:78–80, t. 7. 1925. TYPE: Panama, Veraguas, San Francisco, *Powell 383* (holotype: AMES, photo seen). Figure 35B.

Plant an erect to pendent, cespitose epiphyte; rhizome short; roots to 2 mm in diameter. Pseudobulbs globose, 1-15 mm high, 10-12 mm wide, subtended by nonfoliaceous bracts, apex 1-foliate. Leaves green tinted with maroon, terete, linear, sulcate, acute, 30-40 cm long, 1.5–1.6 wide. **Inflorescence** lateral, paniculate, 40–50 cm long including the scape. Flowers with tepals green spotted with brown, lip yellow, with reddish brown around the callus. Sepals similar, free, concave; dorsal suborbicular, rounded, and apiculate, 5-6 mm in diameter; lateral sepals obovate to triangular, acute to obtuse, 5-6 mm long, 3-4 mm wide. Petals obovate to oblong, obtuse to truncate and apiculate, with undulate margins, 6-8 mm long, 3-4 mm wide. Lip 3-lobate, pandurate, 1.3-1.4 cm long, 1-1.1 cm wide; callus, fleshy, without teeth, a lunate, horizontal plate basally, with a central rounded keel apically, and a pair of blunt lateral keels converging at the central keel apex. Column stout, 3 mm long, with 2 subquadrate to somewhat rounded wings apically; anther papillose, pollinia 2.

Epiphytic in the Golfito area, at 200–300 m. Flowering in April. Costa Rica and Panama; doubtfully reported from Nicaragua.

Oncidium warscewiczii Rchb. f., Bot. Zeitung (Berlin) 10:693–694. 1852. TYPE: Veragua: Chiriquí Vulkan, *Warscewicz* (lectotype selected here: w). Figure 37C.

Plant a cespitose epiphyte 10–30 cm tall excluding inflorescence; rhizome short; roots to 1–2 mm long. Pseudobulb shiny, ovoid to suborbicular, little compressed laterally, 4–9 cm long, 2.5–5 cm wide; subtended by 2–3 foliaceous bracts; apex 2-foliate. Leaves coriaceous, carinate beneath, petiolate; blades 6–30 cm long, 1.8–3 cm wide; apex asymmetrically obtuse. Inflorescence an erect, lateral, secund raceme, somewhat recurved apically, 25–50 cm tall including the scape; ovary with pedicel 1–2.3 cm long, subtended and ex-

ceeded by a cymbiform, acute, and acuminate bract 1.5-3.5 cm long. Flowers campanulate (autogamous?), gregarious, lemon yellow with white callus, rarely marked with red. Sepals dissimilar; dorsal shortly unguiculate, obovate, concave, erect, 14-16 mm long, 5-7 mm wide; lateral sepals connate forming an emarginate blade 1.8-2 cm long, 1-1.2 cm wide. **Petals** ovate, 1.4-1.6 cm long, 8-9 mm wide, margins undulate, apex emarginate. Lip pandurate, concave 1.8-2 cm long, 1.5-1.6 cm wide, ca. 8 mm across lateral lobes; midlobe reniform, emarginate; isthmus ca. 5 mm wide; callus at the base fleshy, complex, farinose, broadened apically. Column large, 8-11 mm long, tabula infrastigmatica lacking, wings narrow, elongate, sometimes forming a lobe at the base. Capsules ellipsoid, 2-3 cm long including the beak; pedicel 1-1.5 cm long.

Epiphytic in cold, windy, montane cloud forests at 1500–2800 m. Flowering August to December. The quantities of capsules formed per inflorescence and the campanulate flowers suggest that at least some plants are autogamous, perhaps self-pollinated when shaken by strong winds. Costa Rica and Panama.

Oncidium warscewiczii is easily recognized by the shiny pseudobulbs, secund racemes with yellow flowers, and large, cymbiform floral bracts. It is closely related to O. bifrons Lindl. (1857), described presumably from Mexico, and may be conspecific.

Excluded Taxa

Oncidium advena Rchb. f., Hamburger Garten-Blumenzeitung 16:422. 1860. Kraenzlin in his monograph cited this species for Costa Rica, but no specimens have been seen. The type from Venezuela includes a painting of the flower showing a broad isthmus similar to that of *O. ensatum* Lindl. or *O. sphacelatum* Lindl.

Oncidium lintriculus Kraenzl., Pflanzenr. IV. 50(Heft 80):282. 1922. TYPE: Costa Rica, *Endres* (w). This entity is known only from the type, consisting of a fragment with flowers that appear immature. The drawing published with the original description looks similar to an immature flower of *O. polycladium* with midlobe not yet expanded, but the anther is clearly beaked.

Oncidium luridum Lindl., Edwards's Bot. Reg. 9: t. 727. 1823. This is reported from Mexico to Nicaragua, the Caribbean region, and northern South America. It might occur in mangrove swamps of the Caribbean coast, which have

been poorly collected, but neither herbarium specimens nor recent observations exist to substantiate its occurrence in Costa Rica.

Oncidium ornithorhynchum Kunth, Nov. Gen. et Sp. Pl. 1:345, t. 80. 1815. This species was listed for Costa Rica by Kraenzl. (Pflanzenr. IV. 50(Heft 80):201. 1922), citing a specimen collected by Endres. R. L. Dressler (pers. comm.) has indicated that this specimen is *O. klotzschianum* Rchb. f.; however, he has also heard of a superior form of *O. ornithorhynchum* said to have originated in Costa Rica.

Oncidium planilabre Lindl., J. Hort. Soc. London 6:59. 1851. This species is known from southern Nicaragua (Maderas Volcano) and from Panama southward. It may occur in Costa Rica, but no specimens have been seen. It should be recognized by the relatively short plant (ca. 30 cm tall) with ovoid, 2-foliate pseudobulbs and raceme of mostly brown flowers with yellow-tipped perianth segments.

Oncidium pumilum Lindl., Edwards's Bot. Reg. t. 920. 1825. This species is recorded for Costa Rica from a single herbarium (SEL 10440) prepared by C. Lankester from cultivated material claimed to have been collected by A. Skutch in the San Isidro area. Lankester often failed to label his plants and their origins, so the plant given him by Skutch was probably something else, perhaps a vegetatively similar species of *Trichocentrum*. Because *O. pumilum* is otherwise known only from South America, it is excluded from the flora.

Osmoglossum Schltr.

(D. E. Mora de Retana)

REFERENCES—E. S. Ayensu and N. H. Williams, Leaf anatomy of *Palumbina* and *Odonto-glossum* subgenus *Osmoglossum*. Amer. Orch. Soc. Bull. 41:687–696. 1972. F. Halbinger, *Odontoglossum* and related genera in Mexico and Central America. Orquídea (Mex.) 8:242–282. 1982.

Plant an epiphytic, cespitose herb. Pseudobulbs ovoid usually congested, compressed, subtended by several, distichous, imbricate bracts, apex 1-2-foliate. Leaves linear-ligulate, coriaceous, flexible, basally conduplicate, acute. Inflorescence a lateral raceme borne at the base of the uppermost leaf subtending the pseudobulb; peduncle compressed and provided with distichous bracts. Flowers nonresupinate, fleshy, spreading or campanulate. Sepals dissimilar; dorsal free, often cucullate; lateral free to variously connate forming a concave synsepal. Petals free, similar to the sepals, membranaceous or fleshy, usually somewhat concave. Lip sessile, porrect or geniculate, simple, adnate to column foot, about the same size as the sepals and petals; callus fleshy. Column short, with short foot, apex winged; pollinia 2, waxy, with stipe and viscidium. Fruit a capsule.

A small genus of about five species ranging from Mexico to Ecuador. Two species are recognized in Costa Rica.

The close relationship of *Osmoglossum* with *Palumbina* cannot be disputed on the basis of vegetative anatomy and gross morphology as found by Ayensu and Williams. Analysis of DNA by Chase and Palmer suggests that related *Palumbina* is a member of the *Lophiaris* clade, including the mule-ear oncidiums.

Key to the Species of Osmoglossum

Osmoglossum convallarioides Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:148. 1923. TYPE: Costa Rica, forests of Santa Rosa de Copey, *Tonduz, s.n.* (drawing of type: AMES). *Odontoglossum convallarioides* (Schltr.) Ames & Correll, Bot. Mus. Leafl. 11:19. 1943. Figure 41C.

Plant epiphytic, cespitose, 30-40 cm tall. Rhizome

short; roots slender, to 2 mm in diameter. **Pseudobulbs** shiny, elliptic-ovoid, sulcate, compressed, 4–8 cm tall, 1–4 cm wide, concealed at the base by 3–5 foliaceous bracts, 1–2-foliate apically. **Leaves** coriaceous, flexuous, linear to narrowly oblanceolate, 25–42 cm long, 0.7–1.4 cm wide, forming a conduplicate petiole at the base, apically acute. **Inflorescence** a lateral raceme 25–30 cm long including the peduncle, borne in the uppermost foliaceous bract; ovary and pedicel 1.5 cm long, rarely exceeded by the subtending floral bract. **Flowers** 3–7, fragrant, small, nonresupinate, campanulate, 10–13 mm

high, 5–7 mm broad, white suffused with rose; callus and column yellowish orange. **Sepals** subequal, elliptic-lanceolate, concave, 7–9 mm long, 4–5 mm wide, acute, with a fleshy apicule; lateral sepals ca. ½ connate. **Petals** elliptic-oblanceolate, concave, 7–9 mm long, 5–6 mm wide, apiculate. **Lip** sessile, adnate to column base, obovate to subpandurate, markedly narrower in lower half, 7–9 mm long, 5–6 mm wide, lightly emarginate; callus basal, fleshy, with 2 short keels extended apically as teeth. **Column** stout, 3–4 mm long, with 2 porrect wings apically; pollinia 2, waxy, with well-developed stipe and viscidium. **Capsule** ellipsoid, 2.4–3 cm long; pedicel 0.8–1 cm long.

Epiphytic on the larger, shady trunks of trees of premontane and lower montane cloud forests at 1400–2000 (2700) m, often forming large masses. Flowering December to April. Reported Mexico to Panama.

Osmoglossum convallarioides is similar to O. egertonii (Lindl.) Schltr., which has larger flowers, nearly totally connate lateral sepals, and nonconstricted lips.

Osmoglossum egertonii (Lindl.) Schltr., Orchis 10:166. 1916. Odontoglossum egertonii Lindl., Edwards's Bot. Reg. 31: misc. 50. 1845. TYPE: Rucker s.n. (K). Osmoglossum acuminatum Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17: 79–80. 1922. TYPE: Panama, Chiriquí, Powell 255 (isotype: AMES). Osmoglossum anceps Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 147–148. 1923. TYPE: Costa Rica, without precise locality, A. and C. Brade 1180 (isotype: AMES). Not Odontoglossum anceps Klotzsch, 1851. Not Odontoglossum anceps Lem., 1856. Figure 41D.

Plant epiphytic, cespitose, 30-40 cm tall. Rhizome short; roots slender, to 2 mm in diameter. Pseudobulbs shiny, elliptic-ovoid, compressed, sulcate, 6-10 cm long, 1.3-3 cm wide, subtended by 3-5 foliaceous bracts, 1-2-foliate apically. Leaves coriaceous, flexuous, linear to narrowly oblanceolate, the larger 25-45 cm long, 1-1.5 cm wide, forming a conduplicate petiole, acute. Inflorescence a lateral raceme 30-40 cm long including the peduncle, usually shorter than the subtending foliaceous bract, rarely 1.2 times as long; rachis somewhat zigzag; ovary with pedicel 1-2 cm long. Flowers small, nonresupinate, white, callus yellowish surrounded with brown, column yellowish. Sepals subequal, obovate, apiculate, 15-16 mm long, 5-6 mm wide; dorsal erect, lateral sepals about ½ connate. Petals similar to the sepals but smaller, obovate. Lip sessile, subrhombic, somewhat concave, apiculate, 13-14 mm long, 5-6 mm wide; callus fleshy, with 2 low keels converging and ending in front as 2 erect teeth, with a broad tooth at column base. Column stout, 5-7 mm long, with 2 porrect, fimbriate wings apically; anther cucullate; pollinia 2, waxy, with well-developed stipe and viscidium. Capsule ellipsoid, to 3.2 cm long; pedicel to 0.8 cm long.

Epiphytic in premontane and lower montane rain forests at 1000–1700 m (ca. 150 m in Talamanca). Flowering October to December. Reported from Mexico to Panama.

Osmoglossum egertonii closely resembles O. convallarioides but has larger flowers, lateral sepals that are connate for about half their length (see previous description), and a lip that is slightly narrower in the lower half. The name O. egertonii may prove not to fit the Costa Rican plants, because the presumed type (Rucker s.n. at K) with drawing shows a more acute lip and apparently less connate lateral sepals. The type locality is indicated as "Guatemala?" in the original description.

Otoglossum (Schltr.) Garay & Dunsterv. (D. E. Mora de Retana)

REFERENCE—G. C. K. Dunsterville and L. A. Garay, Venez. Orch. Ill. 6:41. 1976.

Plant epiphytic, repent to somewhat viny. Pseudobulbs distant, oblong-ovate, subtended by conduplicate sheaths foliaceous or not, apex 1–2 foliate. Leaves fleshy to subcoriaceous, articulate, conduplicate. Inflorescence a lateral raceme. Flowers showy, large, flat or somewhat concave, yellow and reddish brown. Sepals dissimilar, spreading, ovate to obovate, obtuse, forming a short, obtuse mentum at the base. Petals similar to the dorsal sepal, ovate to obovate, obtuse. Lip adnate to column foot, deflexed near the base, 3-lobate, often pandurate, the midlobe sometimes 2-lobate. Column short, stout, with short, broad, recurved foot at base, winged above; pollinia 2 attached to subquadrate stipe by very short caudicles; viscidium small. Fruit a capsule.

A small genus of several (perhaps eight) species ranging from Costa Rica into South America. Only a single species is known from Costa Rica. *Otoglossum* is easily recognized by the widely separated and flattened pseudobulbs hidden by sheathing leaves and showy flowers.

The relationships of *Otoglossum* were considered by M. Chase to be with various species of *Oncidium* and with *Odontoglossum* sect. *Myanthium* (Syst. Bot. 11:477–491, 1986). More recent evidence from DNA analysis (Chase and Palmer 1992) suggests even more complex relationships involving *Ada, Aspasia, Brassia,* and *Symphyglossum*.

Otoglossum chiriquense (Rchb. f.) Garay & Dunsterv., Venezuelan Orchids Ill. 6:41. 1976.

Odontoglossum chiriquense Rchb. f., Bot. Zeitung 10:692. 1852. TYPE: Warscewicz (holotype: w, photo seen). Odontoglossum coronarium var. chiriquense (Rchb. f.) Veitch, Man. Orch. Pl. 1:23. 1886. Figure 41E.

Plant epiphytic, scandent. Rhizome very elongate, covered with rather large foliaceous bracts; roots 3-5 mm in diameter. Pseudobulbs oblong-ovoid, 4-8 cm long, 3-4 cm wide, concealed by 2 or more foliaceous bracts, apically 1-2-foliate. Leaves subcoriaceous, elliptic-ovate, the blade 10-20 cm long, 5-8 cm wide, petiolate at the base, obtuse to rounded apically, apiculate. Inflorescence a raceme of 5–10 flowers borne from the pseudobulb base, 30-45 cm long including the scape; ovary with pedicel 2-4 cm long. Flowers somewhat concave, 3-4 cm high, 5.5-5.8 cm broad; sepals and petals dull red spotted with yellow toward the receptacle; lip yellow at and below the isthmus. Sepals dissimilar with crisped margins; dorsal concave, suborbicular to obovate, rounded and apiculate, thickened abaxially near the base, 2-2.5 cm long, 2-2.3 cm wide; laterals oblong-oblanceolate, rounded and apiculate, 2-3 cm long, 1.5-1.7 cm wide. **Petals** similar to the lateral sepals, slightly constricted on the lower ½, 2-2.5 cm long, 2-2.3 cm wide. Lip 3-lobate, 2.5-2.7 cm long, 1.5-1.7 cm wide; midlobe obovate, forming an isthmus, rounded at the apex; lateral lobes much smaller than the midlobe; callus fleshy with numerous teeth. Column erect, 1 cm long, with small, irregularly toothed wings; pollinia 2, obovate, supported on a viscidium and distinct stipe.

Epiphytic and often rambling over canopies of premontane and lower montane rain forests at 1050–1800 m. R. L. Dressler reports (pers. comm.) that on Cerro Jefe, Panama, it may be found below 1000 m crawling about in open forests where there is sufficient light. Flowering June

to September. Costa Rica and Panama; possibly also into South America.

The very scandent habit of the plant and large, round, reddish brown flowers with mostly yellow lip are good field characters for recognition.

Pachyphyllum Kunth

(J. T. Atwood & D. E. Mora de Retana)

Plant a monopodial, few-branched epiphyte. Stems erect, creeping or pendulous, concealed by leaf sheaths; pseudobulbs lacking. Leaves conduplicate, distichous, articulate, chartaceous, coriaceous to fleshy, usually elliptic to oblong, with variously toothed margins. Inflorescence lateral, short, a few-flowered raceme; pedicel with articulation leaving a stubble behind on abscission. Flowers inconspicuous, green to whitish or yellowish, never red, orange, or purple, campanulate. Sepals similar, sometimes partially connate into a tube. Petals similar to the sepals, often adnate to the sepals forming part of the cup of the tube. Lip usually simple, sometimes somewhat 3-lobate, usually with a pair of tuberculate calli. Column simple, often with broad, dentate wings apically; pollinia 2, with simple stipe, or with a pair of stipes. Fruit a capsule, often 3-alate.

A Neotropical and mostly Andean genus of about 35 species. Three species are known in Costa Rica.

Pachyphyllum is clearly related to Fernandezia Ruiz & Pavon, which differs in the much larger and much more colorful flowers with more complex pollinaria. Dressler (1993) places Pachyphyllum and Fernandezia in subtribe Oncidiinae on the basis of similarity in plant habits with Lockhartia and also on the similarity in pollinaria between Fernandezia and Lockhartia.

Key to the Species of Pachyphyllum

Pachyphyllum costaricense (Ames & C. Schweinf.) L. O. Williams, Lilloa 3:481. 1938.
 Centropetalum costaricense Ames & C. Schweinf., Sched. Orch. 10:110. 1930. TYPE: Costa Rica, San José, near Finca La Cima, above Los Lotes, North of El Copey, Standley

42600 (holotype: AMES, photo seen; drawing of type: SEL).

Plant epiphytic, small and inconspicuous. Stems to 12 cm long, concealed by loose, imbricating leaf sheaths; roots large and stout. Leaves densely disti-

chous, oblong, to 1.6 cm long, 4.5 mm wide, acute or shortly apiculate, spreading, apparently fleshy in the fresh plant, minutely ciliolate especially on the apical margins. Inflorescence a lateral, short raceme of 3-4 flowers; ovary 3-alate; floral bracts funnel-shaped. Flowers white. Sepals fleshy, rigid, oblong-lanceolate or triangular-oblong; laterals ca. 4 mm long, 1.9 mm wide, acute, prominently keeled on the outer surface; dorsal sepal ca. 3.5 mm long, 1.4 mm wide. Petals oblong, similar to the sepals, ca. 1.15 mm wide. Lip rigidly attached to the short column foot, sigmoid when viewed laterally, oblong-lanceolate, with a saccate base, ca. 3.6 mm long, 1.8 mm wide, abruptly acute, apparently somewhat reflexed on the lower 1/2, with a pair of calli. Column short, 1.5 mm long, terminating in a broad, fleshy, lobulate wing; apparently each pollinium with separate stipe.

Endemic to Costa Rica at 2000–2400 m. The holotype was collected in flower in late December. The above description is based on the original description, on floral diagnoses from the type, and on a painting of a dissection showing separate stipes (Rodríguez, Mora, Barahona, & Williams, Géneros de orquídeas de Costa Rica, p. 255. 1986).

Pachyphyllum crystallinum Lindl., Orch. Linden. 18. 1846. TYPE: Venezuela, Merida, 10,000 ft, *J. Linden 686* (holotype: κ, photo seen). *?Pachyphyllum pastii* Rchb. f., Bonpl. 3: 239. 1855. Xen. Orch. 1:165, t. 58, fig. I(1–4). 1856. TYPE: Ecuador, *Jameson 439* (holotype: w, photo seen). *?Pachyphyllum stuebelii* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 7:204. 1920. TYPE: Colombia, Tolima, Volcán de Tolima, *A. Stuebel 213* (holotype: B, destroyed; drawing of holotype: AMES). Figure 42A.

Plant a scandent monopodial epiphyte of moss-covered shrubs and dwarfed trees. Stems to about 30 cm long, rarely branching below, covered by the sheaths of leaves about 5 mm apart; roots white, to 1.3 mm in diameter. Leaves fleshy, elliptic-ovate, apiculate, to 1.5 cm long and 8 mm wide, the margins hispidulous. Inflorescence a short, lateral raceme of 3–5 flowers in the leaf axils, supported by a peduncle to 6 mm long; ovary with jointed pedicel to 1.5 mm long, exceeding the subtending ovate, hispidulous floral bract. Flowers minute, light green, the perianth parts with denticulate margins. Sepals similar, cucullate; dorsal elliptic-ovate, acute, 1.7-1.8 mm long, 0.8-1.3 mm wide; lateral somewhat concave, 2-2.3 mm long, 1-1.3 mm wide. Petals elliptic-ovate, acute, 1.4-1.8 mm long, 0.7-1.1 mm wide. Lip narrowly ovate with the sides inflexed toward the column when young, becoming subsaccate at the base with age, slightly constricted just below the middle, provided with a pair of calli just below the constriction, apex reflexed with maturity, ca. 2 mm long and 1 mm wide in natural position. Column stout, becoming auriculate with maturity, ca. 1 mm long when young, ca. 1.5 mm long at maturity.

Epiphytic on shrubs in cold, wind-swept elfin forests at 3000–4000 m. Flowering season at least July and September and probably throughout the year. Costa Rica, Colombia, and Ecuador.

The small flowers and dentate margins of the separate perianth parts are good features for field recognition with a hand lens. Louis O. Williams used the name *P. pastii* Rchb. f. (Ceiba 5:251. 1956.) for these plants, a name adopted by Atwood (Icon. Pl. Trop. 14: t. 1375. 1989). We thank C. H. Dodson for identifying this species by the earlier name of *P. crystallinum*.

Pachyphyllum hispidulum (Rchb. f.) Garay & Dunsterville, Venez. Orch. Ill. 3:236. 1965. Aeranthus hispidulus Rchb. f., Linnaea 41:31. 1877. TYPE: Colombia, S. Martha, Purdie (holotype: W, photo seen). Campylocentrum hispidulum Rolfe, Orch. Rev. 11:246. 1903. Orchidotypus hispidulus (Rchb. f.) Senghas, Orchideen (ed. 3). 1923. 1995. ?Orchidotypus muscoides Kraenzl., Bot. Jahrb. Syst. 37:383. 1906; Pflanzenr. IV. 50(Heft 83):51, t. 3C. TYPE: Peru, Province of Chota, Department of Cajamarca, Weberbauer 4189. (?)Pachyphyllum muscoides (Kraenzl.) Schltr., Repert. Spec. Nov. Regni Veg. 15:216. 1918. Figure 42B.

Plant an inconspicuous and usually pendent epiphyte 2-6 cm long. Stems weak, branching only at the base, concealed by the sheaths of 10-25 leaves; roots slender, to 1 mm in diameter. Leaves fleshy, distichous, 2-5 mm apart on each side of the stem, the sheaths with hispidulous margins and a pair of stipule-like appendages on each side of the articulation; blades falcate-lanceolate to elliptic, acute, diminishing in size apically, 2.5-8 mm long, 1–2 mm wide, with hispidulous margins. Inflorescence axillary, 1–3-flowered, shorter than the leaves; ovary with rudimentary pedicel about 1.5 mm long. Flowers minute, greenish yellow; the perianth ca. ½ connate forming a tube at the base about 1 mm long. Sepals with free portions ovate, abaxially keeled, to about 1 mm long, < 1 mm wide. Petals with free portions ovate, subsagittate, to about 0.8 mm long, ca. 0.7 mm wide. Lip similar to the petals, with claw united to the perianth tube, the free portion suborbicular, about 1 mm long, with a pair of rounded calli on each side below the base of the blade. Column to about 1.2 mm long, with a broad, cucullate anther bed; pollinia 2, with distinct stipe and viscidium. Capsule suborbicular, ca. 3 mm long, 2 mm wide.

Epiphytic on smaller branches at 2000–3150(3500) m. Flowering at least March, May, September and probably throughout the year. Cos-

ta Rica, Panama (Chiriquí), and at least northern Andean South America.

Plant habit and size match the type of *Aeranthus hispidulus*, and the flowers match those illustrated by Dunsterville and Garay (Venez. Orch. Ill. 3:237) and identified as *P. hispidulum*.

Of the three species of *Pachyphyllum* known in Costa Rica, this is the smallest, with stems less than 5 cm long, and is easily overlooked for a moss.

Plectrophora Focke

(D. E. Mora de Retana)

REFERENCE—M. W. Chase, Obligate twig epiphytism in the Oncidiinae and other Neotropical orchids. Selbyana 10:24–30. 1987.

Epiphytic, cespitose herb. Pseudobulbs small, suborbicular, subtended by conduplicate foliaceous sheaths, apex 1-foliate. Leaves articulate, fleshy, carinate, conduplicate, sometimes equitant. Inflorescence lateral, racemes or panicles with successively borne flowers; ovaries trialate in the Costa Rican species. Flowers campanulate, with conspicuous spur. Sepals subequal, the laterals forming an external spur. Petals usually broader than the sepalis. Lip forming a spur at the base within the sepaline spur; blade simple, often with sides embracing the column. Column stout, usually without conspicuous wings or auricles; anther subglobose; pollinia 2, waxy with stipe and viscidium. Fruit a capsule.

A Neotropical genus of about nine species, most of which are twig epiphytes. A single species is known from Central America.

Little is known of the relationships of *Plectro*phora within the Oncidiinae. Chase (1986) places it within one of two major groups of the Oncidiinae characterized by the usual presence of a spur or nectary.

Plectrophora alata (Rolfe) Garay, Bot. Mus. Leafl. 21:261. 1967. *Trichocentrum alatum* Rolfe. Bull. Misc. Inform. 140:197. 1898. TYPE: Colombia, *Milican* (not seen). Figure 42C.

Plant epiphytic, cespitose, forming small clumps, ca. 15 cm tall. Rhizome very short; roots slender, < 1 mm in diameter. **Pseudobulbs** suborbicular, apically 1-foliate, 5–8 mm long, 6–7 mm wide, concealed at the base by 2–3 papery, triangular bracts. **Leaves** somewhat fleshy, elliptic-oblong, acute, abaxially carinate, 6–8 cm long, 1–1.3 cm wide, conduplicate at the base forming a short petiole. **Inflorescence** a lateral, short raceme of flowers opening successively; ovary and pedicel trialate,

2-2.2 cm long, subtended by much shorter, triangular, acute bracts. Flowers 2.5-3 cm high and 1.9-2.5 cm wide; sepals greenish white, petals white, lip white with pale yellow-orange nectar guides. Sepals subequal, elliptic-lanceolate, acuminate, carinate, directed forward but with the apex lightly recurved, 1.4-1.6 cm long, 4-6 mm wide; lateral sepals forming an external spur 1.9-2 cm long enclosing the spur formed by the lip. Petals much broader than the sepals, elliptic-obovate, 1.6-1.8 cm long, 1–1.2 cm wide, embracing the lip dorsally, the apex somewhat reflexed, retuse, apiculate; margins undulate and erose. Lip narrowed at the base into a spur; blade simple, subrhombic to ovate, adnate to the column, 1.5-1.7 cm long, 1.8-2 cm wide; erose margins undulate, with the sides upturned forming a trumpet and embracing the column; callus of 2 short, parallel lamellae or blunt keels. Column 4-5 mm long, erect, cylindric, narrowed above, without wings; anther subglobose; pollinia 2, waxy, with stipe and prominent viscidium.

An uncommon twig epiphyte in premontane forests in shady, windy habitats at 670–1400 m. Flowering June and September. Costa Rica to northern South America; also reported from Guatemala.

Plectrophora alata is easily recognized by the light-colored, campanulate flowers with conspicuous spur. Unlike species of *Trichocentrum*, it has a sepaline spur enclosing a spur formed by the lip.

Psychopsis Raf.

(D. E. Mora de Retana)

Cespitose epiphytic herb. Pseudobulbs ovoid to suborbicular, compressed, coarsely rugose, 1-foliate. Leaf coriaceous, elliptic to oblong, dark green, often flushed or spotted with purple. Inflorescence a lateral raceme or few-branched panicle with successively borne flowers. Flowers yellow with red-brown markings, rarely pure yellow or yellow and white. Dorsal sepal and petals linear, reflexed; lateral sepals falcate, much shorter and broader than the petals. Lip 3-lobate, provided with a complex basal callus, midlobe broad and deeply emarginate. Column short, with complex auricles; pollinia waxy, 2, with viscidium and stipe. Fruit a capsule.

A Neotropical genus of four species, only one in Costa Rica. *Psychopsis* is easily distinguished by the antenna-like dorsal sepal and petals and by the broad, falcate lateral sepals.

Evidence from DNA analysis by Chase and Palmer suggests that *P. sanderae* is related to fleshy-leaved species of *Oncidium* and *Trichocentrum*.

Psychopsis krameriana (Rchb. f.) H. G. Jones, Novosti Sist. Nyssh. Rast. 12:141. 1975. Oncidium kramerianum Rchb. f., Allg. Gartenzeitung 23:9. 1855. TYPE: Ecuador, "Chimborasso," Warscewicz (holotype: w, photo seen). Oncidium papilio Lindl. var. kramerianum (Rchb. f.) Lindl., Fol. Orch. Oncidium 56. 1855. Papiliopsis krameriana (Rchb. f.) Morren ex Cogn. & Marsch, Pl. Feuill. Ornam. 2:55. 1874. Oncidium kramerianum var. resplendens Rchb. f., Gard. Chron. 3(3):360. 1888. TYPE: Bull 1036 (holotype: w, photo seen). Figure 42D.

Plant epiphytic, cespitose. Rhizome short; roots gravish, 1-2 mm in diameter. Pseudobulbs suborbicular, somewhat compressed, coarsely rugose, 1.9-4 cm long, 2-3.2 cm wide, subtended by nonfoliaceous imbricate bracts, apically 1-foliate. Leaf coriaceous, minutely spotted with dark green or marbled with dull red, elliptic-oblong, 15-30 cm long, 4-6 cm wide, forming a short conduplicate petiole at the base, the apex acute. **Inflorescence** a lateral, erect or lightly arcuate, successively flowering raceme about 80 cm tall including the scape; ovary with pedicel about 2 cm long, subtended by somewhat shorter lanceolate bracts. Flowers large and spectacular, the dorsal sepal and petals reddish or purplish brown, the lateral sepals and lip yellow spotted with reddish brown and with a large yellow region on the lip. Dorsal sepal and petals similar, linear-filiform, 5-7 cm long, 4-6 mm wide, the apical half broadened and with undulate margins; lateral sepals very different from the dorsal sepal, narrowly ovate, falcate, 4-5 cm long, 1.3-1.6 cm wide, the apex subobtuse. Lip 3-lobate, pandurate, with undulate margins, 3.5-5 cm long, 3.2-5 cm wide; lateral lobes subquadrate; midlobe reniform; apex deeply emarginate, contracted at the base into a narrow isthmus; callus between lateral lobes basically of 3 ridges each terminating in a tooth, the central ridge transversely rugose. Column erect, complex, 9-11 mm long, with tabula infrastigmatica below, the apex broadly winged and with a pair of filiform appendages apically; pollinia 2, waxy, with fleshy stipe and viscidium; stigma entire.

Rare epiphyte on large branches in tropical lowland and premontane rain forests at 50–750 m. Flowering mostly September and October; yearround in cultivation. Costa Rica to western Ecuador.

Psychopsis krameriana is easily distinguished by the large successive flowers borne on long scapes and the antenna-like dorsal sepal and lateral petals. With regard to conservation, *P. krameriana* probably has never been a common plant. Currently, it is an extremely rare species in Costa Rica, known populations having been severely decimated by commercial collectors. Wild-collected plants are often hosts for a species of rust, and few plants are allowed through quarantine when brought into the United States. Clearly, mass propagation of selected clones to satiate markets are required to help curb indiscriminate and futile overcollection from wild populations.

Psygmorchis Dodson & Dressler

(D. E. Mora de Retana)

REFERENCE—C. H. Dodson and R. L. Dressler, Two undescribed genera in the Orchidaceae—Oncidiinae. Phytologia 24(4):285–292. 1972.

Plant epiphytic usually on twigs, iris-like, short-lived, without pseudobulbs. Leaves usually numerous, ensiform, remaining conduplicate to the apex, arranged in a fan, without articulations. Peduncle axillary, 1–12-flowered borne in succession. Flowers yellow or with red dots, the lip proportionately large. Sepals and petals similar, yellow, free and spreading or lateral sepals partially connate. Lip strongly 4-lobed and provided with a complex fleshy callus at the base. Column short, 2-winged; pollinia 2, waxy, supported on a stipe and viscidium. Fruit a capsule.

A Neotropical genus of perhaps six species, with two species known in Costa Rica. The plant habit and yellow flowers with large lip are the best characters for field recognition.

Chase and Palmer suggest that Psygmorchis is related to several Brazilian taxa, including Oncidium crispum, O. pubes, and Gomesa planifolia. The unique psygmoid plant habit and reduced chromosome numbers (2n = 10) suggest that Psygmorchis is basically a paedomorphic oncidium.

Key to the Species of Psygmorchis

Psygmorchis pumilio (Rchb. f.) Dodson & Dressler, Phytologia 24(4):288. 1972. Oncidium pumilio Rchb. f., Bot. Zeitung (Berlin) 10:697. 1852. TYPE: not seen. Oncidium gnoma

Kraenzl., Pflanzenr. IV. 50(Heft 80):98–99. 1922. TYPE: Locality unknown, *Sander* (photo of type: AMES). *Oncidium titania* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:67. 1923.

TYPE: Costa Rica, "Carillo" (Carrillo?), Wercklé 63 (drawing of type: AMES). ?Oncidium oberonia Schltr., Repert. Spec. Nov. Regni Veg. Beih. 27:113. 1924. TYPE: Colombia, Mocoa (Territorio del Caqueta), Hopp 207. Oncidium hondurense Ames, Bot. Mus. Leafl. 1(5):31-35, t. 1933. Tolumnia pumilio (Rchb. f.) Hoehne, Iconografia Orch. Bras. 231. 1949. Psygmorchis gnoma (Kraenzl.) Dodson & Dressler, Phytologia 24(4):289. 1972. Figure 43A.

Plant an epiphyte with 1–3 shoots, very small, 1–3.5 cm high excluding inflorescence, rhizome short; roots < 1 mm in diameter. Leaves equitant, fleshy, 10-15 per shoot distributed in a fan; each elliptic-lanceolate and subfalcate in profile, 8-35 mm long, 2-5 mm deep. Inflorescences lateral, 1-several per shoot; each a successively flowering raceme of 2-4 flowers 2-4 cm long including the filiform peduncle; ovary with pedicel 5-7 mm long, subtended by a much shorter ovate, acute floral bract. Flowers yellow, without spots, 8-14 mm high. Sepals dissimilar, dorsal elliptic-ovate, acuminate, 2.5 mm long, 1.7 mm wide; lateral sepals ca. ½ connate, reflexed at the base; each linear-lanceolate, acute, 2.8-3 mm long, 0.6-0.8 mm wide. Petals obliquely ovate, acute, 2.8-3 mm long, 2-2.3 mm wide. Lip 3-lobate, pandurate, 5-6 mm long, 6-7 mm wide; margins undulate; basal lobes broad, dolabriform; midlobe deeply emarginate, obscurely reniform; callus fleshy, cuneate at the base, elevated and papillose apically. Column short, fleshy, 2-3 mm long including conspicuous dolabriform wings beside the stigma; pollinia 2, waxy, with conspicuous stipe and viscidium. Capsules ca. 2 cm; pedicel 5 mm long.

Epiphytic on twigs and vines in tropical lowland and premontane rain forests at 300-1200 m. R. L. Dressler (pers. comm.) relates its occurrence on cultivated azaleas; it is also common in abandoned coffee plantations. Flowering December to February. Reported from Guatemala to northern and Andean South America.

Psygmorchis pumilio appears similar to a miniature P. pusilla, but the flowers are entirely yellow, and the callus has a fimbriate margin. Plants may flower when less than 1 cm tall.

Psygmorchis glossomystax (Rchb. f.) Dodson & Dressler has been reported from Costa Rica. It is similar to P. pumilio in its callus, but generally has larger flowers with reddish brown spots, and the lobes of the lip are more rounded. No herbarium specimens identifiable as O. glossomystax have surfaced from Costa Rica.

Psygmorchis pusilla (L.) Dodson & Dressler, Phytologia 24:288. 1972. Epidendrum pusillum L., Sp. Pl. (ed. 2):1352. 1763. TYPE: not seen. Cymbidium pusillum (L.) Sw., Nov. Act. Upsal.

6:74. 1799. Oncidium pusillum (L.) Rchb. f. Ann. Bot. Syst. 6:714. 1863. Tolumnia pusilla (L.) Hoehne, Icon. Orch. Bras. 231, 1949.

Plant a cespitose twig epiphyte 2.5–8 cm tall, fanlike; rhizome nearly absent; roots to 1 mm in diameter. Pseudobulbs lacking, the stem concealed by leaf bases. Leaves coriaceous to fleshy, conduplicate, distichous, imbricate, falcate-lanceolate in profile, lacking articulations, 2-8 cm long, 3-10 mm deep or high (measured from margin to midrib). Inflorescences lateral in the leaf axils, ≤ 12 per shoot; each a successively flowered, condensed raceme (rarely with 1 branch) to 1.5 cm long supported on a peduncle 1.5-6 cm long covered by 2-3 compressed sheaths each producing a subulate, incurved blade; ovary with pedicel glabrous, 8-10 mm long, subtended by a laterally flattened subulate bract 2-3 mm long. Flowers bright yellow, the petals and base of the lip spotted with brick red; callus and column usually white marked with red. Sepals dissimilar, inconspicuous, about 5 mm long; dorsal ovate, apiculate; lateral sepals lanceolate-falcate, acute. Petals larger than the sepals, ovate-elliptic, 6-8 mm long, 3-5 mm wide. Lip 3-lobate but the midlobe 4-lobulate, 10-18 mm long; 9-20 mm wide, the lateral lobes broadly rounded; midlobe with 4 lobules similarly rounded; margins undulate; callus basal, fleshy, consisting of 1 basal plate, 2 lateral plates, and 1 folded plate at the apex. Column stout, 2.5–3.5 mm long; wings broad, coarsely dentate. Capsules ellipsoid to obovoid, 2–3 cm long; beak short; pedicel short.

Epiphytic mostly on twigs and vines in tropical lowland and premontane rain forests at 0-800 m. Flowering throughout the year. Locally common in Costa Rica; reported throughout most of the Neotropics.

Psygmorchis pusilla has the larger plants and flowers among Costa Rican Psygmorchis. The yellow flower spotted with red and nonfimbriate callus further distinguish it.

Rhynchostele Rchb. f. (Including the following synonyms: Odontoglossum Kunth sect. Rhynchostele

(Rchb. f.) Halb., Cymbiglossum Halb., and Lemboglossum Halb.)

(D. E. Mora de Retana)

REFERENCE—M. Soto Arenas, G. A. Salazar, and A. Rojas, Nomenclatural changes in Rhynchostele, Mesoglossum, and Lemboglossum (Orchidaceae, Oncidiinae). Orquídea (Méx.) 13:145-152, 1993,

Epiphytic or terrestrial cespitose to rhizomatous herb.

Pseudobulbs ovoid, usually strongly compressed laterally, subtended by 1–4 foliaceous bracts; apex 1–2 foliate. Leaves articulate, conduplicate, elliptic to lanceolate, chartaceous to coriaceous. Inflorescence a scapose raceme borne laterally at the pseudobulb base, of 1–20 flowers. Flowers usually spreading, large and colorful. Sepals lanceolate, usually attenuate. Petals often shorter and broader than the sepals, ovate to lanceolate, attenuate. Lip free, with claw with bilamellate callus. Column slender, straight to slightly arcuate, broadened near the stigma; pollinia 2, supported on a viscidium and stipe. Fruit a capsule.

A genus of about 16 species ranging from Mexico to Panama. Three species are confirmed from Costa Rica, although there are reports of five (see notes under *R. hortensiae*). The plants with char-

acteristically large and attractive flowers are valuable to collectors. Probably because of their value, few plants have been preserved as herbarium specimens, making documentation difficult.

The relationships of *Rhynchostele* are unresolved, although the work of Chase and Palmer suggests an alliance of *R. cervantesii* with *Rossioglossum* and *Ticoglossum*. To minimize confusion, we are following R. L. Dressler (pers. comm.) and the reference cited above in recognizing the species included here under the genus *Rhynchostele*. These have been variously accepted under the genera *Odontoglossum*, *Cymbiglossum*, and *Lemboglossum*, and we predict more transfers in the future.

Key to the Species of Rhynchostele

1a. Inflorescence of 10–20 flowers; lip cordate, lavender	R. bictoniensis
1b. Inflorescence of 1-5 flowers; lip trulliform or triangular, whitish, suffused or marked	l with reddish
brown	2
2a. Inflorescence with 2–5 flowers at a time	R. hortensiae
2b. Inflorescence with a single flower at a time	R. stellata

Rhynchostele bictoniensis (Bateman) Soto Arenas & Salazar, Orquídea (Méx.) 13:147. 1993. Cyrtochilum bictoniense Bateman in Orch. Mex. and Guat. t. 6. 1837. Odontoglossum bictoniense (Bateman) Lindl. in Edwards's Bot. Reg. 26:66. 1840. Cymbiglossum bictoniense (Bateman) Halb., Orquídea (Méx.) 9:2. 1983 (nom. illeg.). Lemboglossum bictoniense (Bateman) Halb. ex Christenson, Lindleyana 3:222. 1988. Figure 43B.

Plant epiphytic, somewhat climbing. Rhizome short; roots grayish, 3-5 mm in diameter. Pseudobulbs elliptic, compressed, 5.5-7 cm long, 2.7-3 cm wide, subtended by 2-3 foliaceous bracts; apex 2-3-foliate. Leaves subcoriaceous, elliptic-lanceolate, acute, carinate, conduplicate and articulated to the sheath; blade 17-38 cm long, 2.5–3.6 cm wide. **Inflorescence** lateral from the base of the pseudobulb, a raceme, 25-30 cm long including the scape; ovary with pedicel 3-5 cm long. Flowers 2-3 cm long, 2.5-3.5 cm wide, with tepals greenish yellow spotted with red, lavender lip, column red-maroon. Sepals free, dissimilar, apically and abaxially carinate; dorsal cucullate, elliptic-oblong, acute, apiculate, 1.6-1.8 cm long, 9-11 mm wide; lateral subfalcate, elliptic-lanceolate, acute, apiculate, the margins lightly undulate, 1.9-2.1 cm long, 6–7 mm wide. **Petals** similar to the sepals but smaller, 1.7-1.9 cm long, 6-7 mm wide. Lip subcordate, united by the claw to the base of the column, the margins undulate, 2.3-2.5 cm long and broad; callus a pair of fleshy, elevated keels at the base, with numerous translucent hairs and with 2 lamellae prolonged to

the apex. **Column** semiterete, 1.2–1.5 cm long, apex with a pair of porrect dolabriform wings; pollinia 2, waxy, pyriform, with elongate stipe and viscidium.

In Costa Rica this species grows terrestrially in humus with *Rubus* in montane rain forests at 2000–2500 m. Flowering according to collectors in May, June, September, and October. Reported from Mexico, Guatemala, El Salvador, Costa Rica, and Panama.

Rhynchostele bictoniensis is easily recognized by the elongate raceme with maroon-spotted green tepals and large, subcordate, lavender lip.

Rhynchostele hortensiae (R. L. Rodr. C.) Soto Arenas & Salazar, Orquídea (Méx.) 13:149 1993. Odontoglossum hortensiae R. L. Rodr. C., Orquídea (Méx.) 7:150–154, fig. 1979. TYPE: Costa Rica, Province of Cartago, Glicenstein sub R. L. Rodríguez 1560 (holotype: USJ; isotypes: AMES, F). Lemboglossum hortensiae (R. L. Rodr. C.) Halb., Orquídea (Méx.) 9: 353. 1984. Figure 43C.

Plant a shortly creeping epiphyte. Rhizome short; roots to 3 mm in diameter. Pseudobulbs elliptic-ovoid, strongly compressed laterally, 4–8 cm long, 2.5–4 cm wide, subtended by 2–4 foliaceous bracts, apically 1-foliate. Leaves elliptic, softly coriaceous, acute, apiculate, with a prominent abaxial keel, to 8–20 cm long, 2–

4 cm wide. Inflorescence a lateral, 2–5 flowered raceme borne laterally at the base of the mature pseudobulb, 20– 45 cm long including the scape, scape compressed, partly concealed by triangular, carinate bracts; ovary with pedicel about 3 cm long. Flowers large, 5-7 cm in diameter, greenish white with maroon spots; lip bordered and spotted with dark reddish brown. Sepals free, similar, lanceolate, attenuate, 3.5-4.5 (5.2) cm long, 8-12 mm wide, the margins smooth; dorsal erect; lateral with incurved apices. Petals shorter and broader than the sepals, ovate, attenuate, with undulate margins, 3-4(5) cm long, 1-1.4 cm wide. Lip trulliform to rhombic, united to the base of the column by a short claw, attenuate, 2.6-3.5 cm long, 1.8-2.3 cm wide, the margins coarsely dentate; callus at the base, fleshy, pilose to velutinous, of 2 short, lateral keels and a longer central keel. Column subterete, wingless, with broadened apex, 1.5 cm long; another subglobose; pollinia 2, obpyriform, with elongate stipe and elongate viscidium.

Rhynchostele hortensiae is a species of moist and windy montane cloud forests at 1700–2500 m. It grows upward on trunks and larger branches, appearing repent despite the short rhizome. Flowering March to May. Endemic to Costa Rica.

This species is easily recognized by the pale yellowish green plant, the strongly compressed pseudobulbs formed successively in one direction, and the large, spotted flowers with trulliform lip and dentate margins.

Both R. cordata (Lindl.) Soto Arenas & Salazar and R. maculata (La Llave & Lex.) Soto Arenas & Salazer have been reported from Costa Rica, but no reliable vouchers of these species have been seen. We believe that R. hortensiae has been confused with both species. Rhynchostele cordata, otherwise known from Mexico to Nicaragua and reported from Venezuela, is most similar to R. hortensiae, but the flowers have a more spotted color pattern, and the lip is clearly basally cordate with less dentate margins and a more poorly defined red-purple border. One collection at F (Roy W. Lent 1618) has been repeatedly identified as R. cordata, but the lip base is clearly broadly cuneate with coarsely dentate margin, and the color notes of the collector indicate the "lip edged in the same color [brownish wine-red]." Another specimen (C. H. Lankester s.n. at SEL) is clearly R. cordata and indicates "Candelaria," a Costa Rican locality, but is based on cultivated material that could have easily been confused in cultivation. Charles Lankester is known to have imported and grown orchids from around the world, not just from Costa Rica, and his living plants were not well-labeled.

The occurrence of *R. maculata* is based on a report by C. Horich (Orchideología 10:265–278.

1975), who included a photograph of *R. hortensiae* (not then described) as *Odontoglossum maculatum*. Rodrigo Escobar (Orquideología 11:21–49. 1976), when writing about *Odontoglossum maculatum*, stated, "but a variety exists in Costa Rica, with white, instead of yellow petals." This probably was of *R. hortensiae*. Without verifiable herbarium specimens, we cautiously exclude both *R. cordatum* and *R. maculatum* from the flora.

Rhynchostele stellata (Lindl.) Soto Arenas & Salazar, Orquídea (Méx.) 13:151. 1993. Odontoglossum stellatum Lindl., Edwards's Bot. Reg. 27: misc. 9. 1841. TYPE: Mexico, Hartweg (κ, not seen) Cymbiglossum stellatum (Lindl.) Halb., Orquídea (Méx.) 9:4. 1983. Lemboglossum stellatum (Lindl.) Halb., Orquídea (Méx.) 349. 1984. Figure 43D.

Plant a cespitose epiphyte, 10-15 cm high; rhizome short; roots to 2 mm in diameter. **Pseudobulbs** ovoid to lanceolate, compressed, 2.5-8 cm long, 1.3-1.5 cm wide, subtended by nonfoliaceous sheaths, apex 1-foliate. Leaves petiolate; blade subcoriaceous, carinate, elliptic to lanceolate or oblanceolate, 10–14 cm long, 1.5– 2 cm wide; apex acute. Inflorescences 1-2 per shoot, scapose, lateral, with 1 rarely 2 successive flowers; triquetrous ovary with pedicel 4-7 cm long, subtended by a much shorter lanceolate bract 7-10 mm long. Flowers large and attractive; sepals and petals yellowish brown with yellow apices, lip white suffused with lavender. Sepals free, similar, linear elliptic to lanceolate, attenuate, 1.9-2.2 cm long, 3-4 mm wide. Petals similar to the sepals, 1.9-2.2 cm long, 3-4 mm wide. Lip with a claw about 8 mm long, parallel with and embracing the column; blade reflexed, simple to lightly 3-lobate, concave, ovate to rhombic, 2.8-3.2 cm long, 1.7-2 cm wide; apex acute to obtuse; margins coarsely dentate and undulate; callus at the base fleshy, projected beyond the claw, as a pair of small, lateral teeth, in front of which is an additional, emarginate callus. Column straight, broadened at the apex, lightly verrucose, 1.3-1.5 cm long; anther shortly beaked; pollinia 2, with elongate stipe and viscidium. Capsules from Costa Rica unknown, in one specimen from Mexico 3.1 cm long including the beak.

Rhynchostele stellata grows in cloud forests at about 1500 m. Flowering May and June. Reported from Mexico to Panama (not Nicaragua) and Venezuela.

Rhynchostele stellata is easily recognized by the single, proportionately large flower per inflorescence supported on a long pedicellate, triquetrous ovary. It is known in Costa Rica by a single collection near Ciudad Quesada made by an inspector from the Costa Rican wildlife office. It was to be expected in Costa Rica because it is

known from both northern Central America and Panama.

Rodriguezia Ruíz & Pavón

(D. E. Mora de Retana)

Plants epiphytic, cespitose to rhizomatous, often forming large clumps; rhizome short or elongate, covered by persistent bracts. Pseudobulbs compressed, apex 1–2-foliate. Leaves conduplicate, coriaceous, ligulate to elliptic. Inflorescences 1–several, each a raceme formed in the axils of the foliaceous bracts. Flowers usually showy. Sepals dissimilar, the dorsal erect, the lateral sepals variously connate forming a spur. Petals subequal to the dorsal sepal. Lip usually exceeding the sepals, entire or emarginate. Column erect, the apex dilated and often with a pair of auricles, the base footless; pollinia 2, waxy. Fruit a capsule.

A Neotropical genus of about 34 species, but with only one species in Costa Rica. In Mesoamerica, a second species, *R. lanceolata* Ruíz & Pavón, occurs in neighboring Panama, and *R. dressleriana* R. González has been described from Mexico.

Cladistic analysis based on DNA strongly supports a relationship with *Scelochilus* and *Comparettia*.

Rodriguezia compacta Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:144. 1923. TYPE: Costa Rica, Atlantic coastal hills, A. & C. Brade 1309, 1310 (drawing of type: AMES, photo seen). Figure 44A.

Plant epiphytic, never forming large clumps, to about 15 cm tall. Rhizome short; roots rather large, to 1.5 mm in diameter. Pseudobulbs compressed, ovoid, 1.5-3.5 cm long, 1-1.3 cm wide, nearly covered by the sheaths of 3-6 foliaceous bracts; apex 1(2)-foliate. Leaves coriaceous, articulate, oblong to elliptic, broadly rounded or obtuse apically, appearing unequally 2-lobed in pressed specimens, 3.5-15 cm long, 1.2-3 cm wide. Inflorescences lateral, 1-several per shoot, each a raceme of 1-5 flowers, 5-8 cm long including the peduncle, much shorter than the leaves; ovary with pedicel to about 1.5 cm long, each subtended by a conduplicate, subulate bract 5-15 mm long. Flowers white to light yellow, the lip yellow with 2 orange lines opposite the column apex. Sepals dissimilar; dorsal oblanceolate, 1.8-3.3 cm long, 8-13 mm wide, obtuse; lateral sepals connate forming an oblong synsepal, more or less conicsaccate at the base concealing the nectary, bifid apically, 1.5-3 cm long, about 10 mm wide. Petals oblanceolate to subspatulate, rounded to lightly emarginate when flattened and apiculate, 2-3 cm long, 8-15 mm wide, the margin minutely dentate. Lip cuneate, obovate to spatulate when flattened, 2-3.5 cm long, 1.3-1.5 cm wide, with a recurved spur at the base, with margins inrolled forming a tube, emarginate apically; callus with 2 fleshy keels. Column clavate, 1.5–1.7 cm long with a pair of falcate auricles apically; anther with beak, pollinia 2, with long stipe.

Epiphytic in lowland rain forests at 15–100 m; in Nicaragua recorded to 200 m. Flowering June to November. Locally common from Nicaragua to Panama.

This species is easily recognized in Costa Rica by the shape of the column with apical horns and the synsepal forming a recurved spur.

Rossioglossum (Schltr.) Garay & Kennedy (D. E. Mora de Retana)

REFERENCE—L. A. Garay and G. Kennedy, The genus *Rossioglossum*. Orch. Dig. 40:139–143. 1976.

Plant a cespitose epiphyte; rhizome short; roots thick. Pseudobulbs suborbicular to ovoid or obovoid; subtended by nonfoliaceous bracts; apex 2-foliate. Leaves petiolate, conduplicate. Inflorescence a lateral raceme of 3–20 flowers. Flowers large and attractive, yellow marked variously with reddish brown. Sepals similar. Petals usually broader than the sepals. Lip 3-lobate; callus fleshy, with several teeth. Column stout, with lanceolate wings apically; pollinia 2, supported on a stipe and viscidium. Fruit a capsule.

A small Mesoamerican genus of five to six species, one in Costa Rica. Relationships are unclear but are apparently with *Ticoglossum* and possibly *Palumbina* and *Rhynchostele*.

Rossioglossum schlieperianum (Rchb. f.) Garay & Kennedy, Orch. Dig. 40:143. 1976. *Odonto-glossum schlieperianum* Rchb. f., Gard. Chron. 1082, (fig.). 1865. TYPE: Costa Rica, ?Wendland (w, not seen). Figure 44B.

Plant an erect, cespitose epiphyte to about 40 cm tall; rhizome short; roots ≤ 4 mm in diameter. Pseudobulbs grayish green, biconvex, lightly sulcate, ovoid to obovoid, 4–9 cm long, 2.5–6.5 cm wide; subtended by nonfoliaceous bracts; apex sometimes emarginate, 2(3)-foliate. Leaves deep gray-green, base forming a conduplicate petiole; blade subcoriaceous, carinate abaxially, elliptic-oblanceolate, 10–30 cm long, 3–7 cm wide; apex acute. Inflorescence a lateral raceme of 3–8 flowers 25–40 cm high including scape; ovary with pedicel 3–6 cm long, subtended by a membranaceous, cymbiform bract 1.5–2.5 cm long. Flowers sulfur yellow; tepals barred with rust red on lower half; lip whitish with reddish brown isthmus; callus yellow and red. Sepals subequal, elliptic, acute or apiculate, margins undulate; dorsal

erect, 4.5–5.2 cm long, 1.5–2.1 cm wide; lateral connate basally, subfalcate, 4.5–5.2 cm long, 1.4–1.7 cm wide. **Petals** much broader than sepals, elliptic ovate to obovate, 4.8–5 cm long, 2–2.3 cm wide, acute to obtuse and apiculate, margins undulate. **Lip** 3-lobate, 3.1–4 cm long, ca. 1 cm across the lateral lobes, 1.9–2.4 cm wide at the apex; lateral lobes rounded; midlobe obovate, concave, the apex lightly to deeply emarginate; callus at the base prominent and fleshy, of 4 diverging teeth, the apical pair particularly thickened and mammillate. **Column** short, erect, about 1 cm long, broadened apically and with 2 pubescent, lanceolate auricles; pollinia 2, waxy, with stipe about 1.5 mm long and viscidium. **Capsule** 5–6 (or more?) cm long.

Trunk epiphyte in moderate shade of very tall trees in humid evergreen cloud forests at 1200–1800 m. Flowering May to July. Costa Rica and Panama.

Rossioglossum schlieperianum is easily distinguished in Costa Rica by the large yellow flowers marked with reddish brown. Pure yellow forms have been reported.

Excluded Taxon

Rossioglossum williamsianum Rchb. f., Gard. Chron. 16:134. 1881. TYPE: B. S. Williams. This was reported by B. S. Williams (Orchid Grower's Manual, 1894) as having been imported from Costa Rica in a shipment with Odontoglossum (Rossioglossum) schlieperianum. The report has since been repeated by others, but no recent specimens nor reliable reports support Williams' claim. It is most likely that the species originated from northern Central America and the labels were confused in cultivation.

Scelochilus Klotzsch (Including *Neokoehleria* Schltr.)

(D. E. Mora de Retana)

REFERENCE—K. Senghas, Die Gattung Scelochilus, mit einer neuen Art, Scelochilus rubriflora, aus Peru. Orchidee (Hamburg) 38:114–123. 1987.

Cespitose, usually small, epiphytic herb. Pseudobulbs small, sometimes hidden by subtending, rarely foliaceous sheaths; apex 1-foliate. Leaves conduplicate, coriaceous. Inflorescence a lateral raceme or panicle. Flowers colorful, small, campanulate, with conspicuous spur. Sepals dissimilar, the laterals variously connate, forming a single spur at the base. Petals simple, similar

to the dorsal sepal. **Lip** complex, elongate; base with a pair of spurs included within the sepaline spur; apex broadened, often with involute margins; lamina usually adorned with 1–2 pairs of horns and variously pubescent. **Column** usually clavate; pollinarium variable, pollinia 2, with short to elongate, rarely furcate stipe and viscidium. **Fruit** a capsule.

A genus of perhaps 50 montane species with small, very odd, colorful flowers superficially similar to those of *Corydalis*. The center of distribution is in Andean South America with possibly two in Central America, with only one known from Costa Rica.

Floral morphology as well as DNA evidence of Chase and Palmer suggest that *Scelochilus* is related to *Comparettia* and *Rodriguezia*.

Scelochilus aureus Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:144–145. 1923. TYPE: Costa Rica, Tabbazo (Tablazo), A. & C. Brade 1063 (drawing of type: AMES). Figure 44C.

Plant a small, cespitose, pendent or arcuate epiphyte; rhizome short; roots to 1 mm in diameter. Pseudobulbs subcylindric to fusiform, compressed, 2.2-2.4 cm long, 4-6 mm wide; subtended by 2-3 subulate, nonfoliaceous bracts; apex 1-foliate. Leaves coriaceous to fleshy, petiolate; blade elliptic-lanceolate or oblanceolate, carinate beneath, 8-12 cm long, 1.5-3.7 cm wide; apex recurved and acuminate. Inflorescence lateral, arcuate or pendent, a raceme or panicle, 12-15 cm long including scape; each branch with 4-6 successively borne flowers; ovary with pedicel 8-11 mm long subtended by subulate bracts ca. 5 mm long. Flowers campanulate, 1.2-1.6 cm long, yellow to orange; petals and lip lined with wine red. Sepals dissimilar; dorsal free, concave, oblong-obovate, obtuse, 1.2-1.4 cm long, 8-9 mm wide; laterals connate forming a synsepal 1.4-1.6 cm long, 8-10 mm wide, spur at base 4 mm long, apex emarginate. Petals similar to dorsal sepal in shape and size. Lip complex, elongate, 1.4-1.6 cm long, 4-5 mm wide, with 2 spurs inserted within the sepaline spur; blade with a pair of slender, acute, retrorse, hornlike auricles near the middle and a second pair near base of apical lobe, lightly velutinous; apex suborbicular and emarginate with involute margins. Column subterete, dilated apically, lightly velutinous ventrally, 8 mm long; pollinia 2, globose, supported on a furcate stipe and viscidium.

Rare epiphyte on small branches of windy premontane and lower montane cloud forests at 1500–2000 m. Flowering season imperfectly known, at least August to October; possibly June to December during the rainy season. Apparently endemic to Costa Rica.

The yellow to orange, campanulate flowers appearing similar to those of *Corydalis* (Fumariaceae) are good features for field recognition.

We exclude S. aureus from synonymy with S.

tuerckheimii Schltr., a species described from Guatemala with smaller flowers and a narrower, rounded midlobe. The larger flower size, emarginate midlobe of lip, and the shorter notch produced by the lateral sepals agree with *S. aureus*, not *S. tuerckheimii*; both are otherwise very closely related species. Schlechter's descriptions of the column and ovary ("c. 2 cm longo") in *S. aureus* match nothing seen from Costa Rica and are probably erroneous. The above description is based in part on plants recollected in the type locality.

Sigmatostalix Rchb. f.

(D. E. Mora de Retana)

Plant a cespitose epiphyte. Rhizome short, rarely creeping; roots slender. Pseudobulbs small, elliptic to oblong to ovoid, compressed, subtended by several imbricate, folia-

ceous bracts; apex 1–2-foliate. Leaves linear to elliptic-lanceolate, acute, acuminate or asymmetrically 2-lobate. Inflorescence a lateral raceme or panicle with few—many flowers; usually each shoot with several inflorescences at the same time. Flowers small, often accompanied by several bracts beneath the floral bract; floral bracts membranaceous, triangular, often funnel-shaped. Sepals subequal, spreading or reflexed, free or connate at the base. Petals similar to the sepals. Lip conspicuous, subsessile or long-clawed, often united to the base of the column, entire or 3-lobate, usually with fleshy callus. Column slender and arched or stout, terete, erect, often dilated at the apex; pollinia 2, waxy, ovoid on a single stipe and with filiform caudicles. Fruit a capsule.

A Neotropical genus of about 35 species; six species are here treated for Costa Rica. The genus is easily recognized by the usually small flowers (often brightly colored) with bizarre shapes and usually very slender, arcuate column and the tendency to produce several bracts per flower. Sigmatostalix is apparently related to several sections of Oncidium, but little more is known of its relationships.

Key to the Species of Sigmatostalix

1a. Lip with claw	2
2a. Claw of the same length as the blade of the lip; lateral lobes of lip prominent and slender	er
S. unguio	
2b. Claw shorter than the blade of the lip; lateral lobes neither prominent nor slender	
3a. Claw $> \frac{1}{4}$ the width of the lip; blade reniform, lateral lobes reflexed S.	
3b. Claw $< \frac{1}{4}$ the width of the lip; blade subpandurate, with 2 teeth in front of callus.	
S. br	ownii
1b. Lip without claw	4
4a. Lateral sepals free or shortly connate, lip suborbicular	
4b. Lateral sepals ca. 1/3 connate; lip obovate	5
5a. Inflorescence about as long as the leaves or shorter, callus prominently 2-lobate, v	vith a
reddish brown band at the base of the lip	antha
5b. Inflorescence much longer than the leaves, callus obscurely 3-lobate, lip without ba	ınd at
base S. aa	amsii

Sigmatostalix adamsii Dodson, Selbyana 2:54–56. 1977. TYPE: Ecuador, Pichincha, Santo Domingo, 650 m, *Dodson et al.* (holotype: SEL). Figure 46A.

Plant a cespitose epiphyte 12–15 cm high. Rhizome short; roots to 1 mm in diameter. Pseudobulbs ellipticovoid, compressed, 1.5–3 cm long, 1.3–1.5 cm wide, subtended by 2–3 foliaceous bracts, apically 1-foliate. Leaves subcoriaceous, linear-lanceolate, carinate beneath, acute, 10–15 cm long, 1–1.3 cm wide. Inflorescence a lateral, slender, many-flowered panicle longer than the leaves, 15–20 cm long including the scape; ovary with pedicel 5 mm long subtended by numerous membranaceous, obovate bracts. Flowers white to yellow, the lip yellow, column white. Sepals dissimilar,

membranaceous, concave, ovate-lanceolate, acute, 2–2.2 mm long, 0.5–0.6 mm wide, the dorsal free, the laterals at least ½ connate. **Petals** similar to the dorsal sepal, ovate-lanceolate, acute, incurved, 2–2.2 mm long, 0.5–0.65 mm wide. **Lip** sessile, ovate, acute, 3–4 mm long, 1.2–1.5 mm wide; margins undulate. **Column** rather stout for the genus, dilated at the apex, 2 mm long, anther cucullate; pollinia 2, with viscidium and stipe.

An uncommon epiphyte on twigs and smaller branches, usually in disturbed evergreen forests. Ecuador and possibly in Costa Rica, where it has been seen in living private collections.

This species is easily distinguished in Costa Rica by the slender inflorescence with numerous brown bracts at the base of the flowers.

Sigmatostalix brownii Garay, Caldasia 10:236. 1968. TYPE: Panama, *Brown* (AMES). Figure 45C.

Plant cespitose or shortly creeping, epiphytic, 12–15 cm high. Rhizome short; roots ca. 1 mm in diameter. Pseudobulbs red-brown, ellipsoid-ovoid, compressed, 2-4 cm long, 1-1.5 cm wide, subtended by 2-4 foliaceous bracts when young, apically 1(2)-foliate. Leaves subcoriaceous, lanceolate, carinate beneath, 8-15 cm long, 6-10 mm wide, acute. Inflorescence lateral, manyflowered, a condensed panicle with primary branches with a single flower, appearing as a raceme, 8-15 cm long including the scape, subtended by a membranaceous, obovate bract; ovary with pedicel 2 mm long subtended by 2 or more bracts. Flowers pale green; sepals with red-brown, transverse bars (especially the laterals), lip purplish red. Sepals subequal, oblong to lanceolate, carinate, 3-3.3 mm long, 1-1.5 mm wide, acute and apiculate; dorsal concave; lateral sepals recurved and subfalcate; margins undulate. Petals lanceolate, falcate, 2.5-2.8 mm long, to about 1 mm wide, acute. Lip elliptic-ovate, 2.5-3 mm long, 2-2.3 mm wide; margins undulate; callus on lower 1/2, fleshy, massive, with two projecting teeth in front. Column erect, dilated apically, 2 mm long; pollinia 2, with clavate stipe and viscidium.

Uncommon epiphytes on twigs and smaller branches, usually in disturbed evergreen forests at 50–600 m. Flowering September to December. Costa Rica and western Panama.

Sigmatostalix hymenantha Schltr., Beih. Bot. Centralb. 36:419. 1918. TYPE: Costa Rica, Curillo, 300 m Wercklé (AMES, a drawing). Figure 45D.

Plant cespitose, epiphytic, 12-18 cm high. Rhizome short; roots to 1 mm in diameter. Pseudobulbs ellipsoidovoid, compressed, 1.5-3.5 cm long, 1.5-2 cm wide, subtended by 2-4 foliaceous bracts, apically 1-foliate. Leaves subcoriaceous, linear-lanceolate, carinate beneath, 10-24 cm long, 4-13 mm wide, acute. Inflorescence a lateral, many-flowered panicle about as long as the leaves, 4-20 cm long including the scape; ovary with pedicel 5 mm long, subtended by numerous membranaceous, obovate bracts. Flowers white to yellow, the lip darker yellow with red band at the base of the callus, column white. Sepals similar, membranaceous, concave, ovate-lanceolate, acute 3–3.3 mm long, 1–1.1 mm wide; the dorsal free, the laterals shortly connate at the base. Petals similar to the sepals, ovate-lanceolate, concave, 3-3.2 mm long, 1-1.1 mm wide, acute. Lip sessile, suborbicular to subquadrate, reflexed, 3-3.2 mm long, 1.2-1.5 mm wide, acute; margins undulate; callus fleshy, elevated, transversely 2-lobate, concave, the cavity containing an oil in live plants. Column stout, dilated apically, 1.5-2 mm long; anther cucullate; pollinia 2, with stipe and viscidium. Capsule globose, ca. 5-6 mm long, pedicel ca. 5 mm long.

An epiphyte on twigs and smaller branches, usually in disturbed evergreen forests at (50)350-

950 m; often seen growing on citrus, hibiscus, and coffee. Flowering December to May. Costa Rica, Panama, and South America.

Sigmatostalix hymenantha is easily distinguished by the paniculate inflorescence with a cluster of brown bracts at the base of each flower.

Sigmatostalix macrobulbon Kraenzl., Pflanzenr. 80:307. 1922. TYPE: Costa Rica, *Endres* (W). Figure 45B.

Plant cespitose, epiphytic. Rhizome short; roots white, to 1 mm in diameter. Pseudobulbs elliptic-ovate, strongly compressed, 3-3.5 cm long, 1-1.5 cm wide, subtended by 2-3 foliaceous bracts when young. Leaves subcoriaceous with conduplicate petioles; blade linearlanceolate to elliptic, carinate beneath, 6-15 cm long, 6-17 mm wide, acute. Inflorescence a lateral, many-flowered raceme much longer than the leaves, 5-20 cm long including the scape; ovary with pedicel 5 mm long subtended by a membranaceous, obovate bract. Flowers greenish, pale, or bright yellow, the lip with orange-yellow callus, the column white. Sepals dissimilar, membranaceous, the dorsal free, erect, ovate-lanceolate, 3 mm long, 1.5 mm wide, concave at the base, apiculate at the apex; lateral shortly connate, strongly reflexed, ovate-lanceolate, 3.5-4 mm long, 1.5-1.7 mm wide, carinate beneath, apiculate. Petals elliptic-ovate, 3.5-4.2 mm long, 2-2.2 mm wide, acuminate, with the margins undulate and strongly recurved. Lip sessile, suborbicular to subquadrate, strongly convex, 3-3.2 mm long, 5-5.1 mm wide, the apex emarginate, the margins undulate; callus on lower 1/3 fleshy, elevated, round with a triangular cavity containing an oil in the live plant. Column elongate, dilated at the apex, 4 mm long; anther cucullate; pollinia 2, with stipe and viscidium. Capsule ellipsoid, ca. 5 mm long; pedicel about 7 mm.

Epiphytic in tropical lowland and premontane rain forests at (400)850–1700 m, where it usually grows on smaller branches in windy habitats. Flowering September to February. Costa Rica and Panama.

Sigmatostalix macrobulbon can be easily distinguished by the flowers, which have a strongly convex lip with fleshy, muffin-shaped callus with triangular cavity. When held under water, the oil droplets within the cavity float to the surface.

Sigmatostalix picta Rchb. f., Ann. Bot. Syst. 6: 859. 1864. TYPE: Ecuador, Quito, *Jamieson* (W). ?S. costaricensis Rolfe, Bull. Misc. Inform. 78. 1916. S. poikilostalix Kraenzl., Pflanzenr. IV. 50(Heft 80):310. 1922. TYPE: Costa Rica, Endres 38, 97 (syntypes: W). Figure 45A.

Plant cespitose, epiphytic. Rhizome short; roots 1–1.2 mm in diameter. **Pseudobulbs** oblong, compressed, 2–3 cm long, 1–2 cm wide, subtended by 2–4 foliaceous bracts,

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apically 1-foliate. Leaves with blades oblong-lanceolate to elliptic, keeled abaxially, 1.5-13 cm long, 0.7-2 cm wide, acute. Inflorescence a slender, lateral, many-flowered raceme or condensed panicle with single-flowered primary branches, to 30 cm long; ovary with pedicel 8 mm long. Flowers yellow with brown marks on sepals, petals, and lip; lip apical margin yellow. Sepals ovate-lanceolate, reflexed, 8-11 mm long, 2-3 mm wide, acute; dorsal free, the lateral shortly connate. Petals similar to the sepals, ovate-lanceolate, reflexed, 8-10 mm long, 2-2.2 mm wide, acute. Lip spreading, clawed; blade anchor-shaped, somewhat convex, 7-7.2 mm long, 7-7.2 mm wide, apex shallowly emarginate, apiculate; lateral lobes recurved; callus erect, with 3 more or less rounded teeth. Column elongate, arcuate, apically dilated, 6 mm long; anther cucullate; pollinia 2, oblong with elongate stipe and viscidium. Capsule ellipsoid, 1–1.5 cm long with beak, pedicel 3–4 mm long.

Epiphytic and uncommon in evergreen forests at 500–1800 m. Flowering August to February. Reported from Nicaragua to South America.

Sigmatostalix picta is easily distinguished by the relatively large, red and yellow flowers with long claw and recurved lateral lobes. As used here, the name represents a complex of species in need of revision. In a narrower sense, S. picta, based on Ecuadorian material, may apply to any of several South American species with differing color patterns, in which case S. costaricensis Rolfe is probably the next available name. Sigmatostalix guatemalensis Schltr. may be a later synonym (1911) but differs in flower color, which lacks red pigmentation.

Sigmatostalix unguiculata C. Schweinf., Bot. Mus. Leafl. 8:55–57. 1940. TYPE: Costa Rica, Province of San José, vicinity of El General, *Skutch 3020* (holotype: AMES). Figure 44D.

Plant cespitose, epiphytic, to 15 cm high. Rhizome short; roots flexuous, to 1 mm in diameter. Pseudobulbs ellipsoid to ovoid, compressed, 1.2–2 cm long, 1.2–2 cm wide, subtended by 8–10 foliaceous bracts, apically 1-foliate. Leaves subcoriaceous, linear-oblong to elliptic, carinate beneath, 4–7 cm long, 5–8 mm wide, apically 2-lobate. Inflorescence a lateral, many-flowered raceme about as long as the leaves, 6–7 cm long including the scape; ovary with pedicel 7 mm long. Flowers small, spreading, yellow to yellow-green. Sepals similar, reflexed, membranaceous, ovate-lanceolate, acute, 5.8–6

mm long, 1.8–2 mm wide, acute; dorsal free; lateral slightly oblique. **Petals** similar to the sepals, ovate-lanceolate, oblique, 5.8–6 mm long, 1.8–2 mm wide, acute. **Lip** long unguiculate, the claw linear, the blade 3-lobate, abruptly deflexed, 6–6.1 mm long, 2–2.1 mm wide; lateral lobes falcate and hornlike, fleshy, pubescent; callus fleshy, 2-lobate at the intersection of the 3 lobes and containing an oil. **Column** slender, elongate, arcuate, dilated apically, 5 mm long; anther cucullate; pollinia 2, with stipe and viscidium.

Epiphytic and rare in evergreen forests at 500–975 m. Flowering October to December. Apparently endemic to Costa Rica.

Sigmatostalix unguiculata is easily recognized by the long, slender claw and the arcuate, narrow, porrect, lateral lobes of the lip.

Systeloglossum Schltr.

(D. E. Mora de Retana)

REFERENCE—R. L. Dressler and N. H. Williams, The genus *Systeloglossum*. Amer. Orch. Soc. Bull. 39:323–329, 1970.

Epiphytic, cespitose, or rhizomatous and somewhat creeping herb. Pseudobulbs present, strongly compressed, subtended by 3–4 foliaceous sheaths; apex 1-foliate. Leaves and foliaceous sheaths subcoriaceous, conduplicate. Inflorescence a raceme or panicle with primary branches. Flowers green, yellowish, or suffused with purple. Sepals dissimilar; dorsal concave; lateral connate and adnate to the column foot apically as well as laterally. Petals united laterally to base of lateral sepals. Lip simple, united with column foot forming a nectary; blade unguiculate, suborbicular to ovate, with simple calli usually of a pair of swellings. Column stout with broad wings; pollinia 2 supported on a squarrose stripe and viscidium (Costa Rican species). Fruit a capsule.

A Neotropical genus of five species native to rain forests from Costa Rica (two species) to Andean South America.

Systeloglossum forms a rather isolated group with *Diadenium* and *Oliveriana*. No evidence from DNA studies is available to link this group with others.

Key to the Species of Systeloglossum

- 1b. Column foot much shorter than column; floral bracts 2-4 mm long; pseudobulbs clearly visible . .

Systeloglossum acuminatum Ames & C. Schweinf., Sched. Orch. 10:105–106. 1930. TYPE: Costa Rica, La Estrella, *Lankester 1091* (holotype: AMES, photo seen). Figure 46B.

Plant epiphytic, cespitose to somewhat repent; rhizome segments 3–5 cm long per shoot; roots \leq 2 mm in diameter. Pseudobulbs cylindric, narrow, smooth, compressed, 2-2.6 cm long, ca. 5 mm wide, usually concealed and subtended by 3-7 oblong-lanceolate foliaceous bracts; apex 1-foliate. Leaf linear-elliptic, base conduplicate, thin, 8-25 cm long, 0.6-1.5 cm wide; apex asymmetric, attenuate. Inflorescence lateral, a raceme or few-branched panicle, 10-30 cm long including scape, successively flowered; ovary with pedicel ca. 1 cm long, subtended by an acuminate floral bract 5-6 mm long. Flowers green. Sepals somewhat fleshy, dissimilar; dorsal oblong-elliptic, adnate to the base of the petals, 9-12 mm long, 3-4 mm wide, apex obtuse and thickened; lateral sepals connate forming an abaxially 2-keeled, elliptic-ovate, deeply emarginate synsepal 1.1-1.8 cm long, 4-6 mm wide, united to the end of the column foot. Petals adnate to the base of sepals, triangular-lanceolate, carinate, lightly reflexed, 7-8 mm long, 4 mm wide, acute. Lip shortly unguiculate, forming a broad nectary with foot, adnate to base of column; blade suborbicular, convex, ca. 6 mm long, 6 mm wide, emarginate; callus of 2 semiglobose protuberances below the middle. Column erect, fleshy, with broad, crenulate wings apically, 3 mm long, 7 mm including foot; foot 4 mm long; pollinia 2, fleshy, translucent, with squarrose stipe and viscidium. Capsules ellipsoid, 2-3.5 cm long including beak, pedicel ca. 1 cm long.

Epiphytic in montane rain forests at 1100-2000 m. Flowering October to April, perhaps throughout the year. Endemic to Costa Rica.

Systeloglossum acuminatum is distinguished from S. costaricense Schltr. by the smaller pseudobulb, the somewhat longer column foot, and the less dense inflorescence with longer acuminate floral bracts. Plants and flowers of S. acuminatum are less suffused with brown or purple, and the leaves are generally more slender.

Systeloglossum costaricense Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:252–253. 1923. TYPE: Costa Rica, Alto de Santiago de San Ramón, *Brenes 19* (drawing of type: AMES). Figure 46C.

Plant epiphytic, cespitose to distinctly repent; rhizome segments ≤ 3.5 cm long per shoot; roots ≤ 2.5 mm in diameter. **Pseudobulbs** conspicuous, elliptic to ovate, smooth, strongly compressed laterally, 3–7 cm long, 1–2.1 cm wide, subtended by 3–6 oblong-lanceolate foliaceous bracts; apex 1-foliate. **Leaf** brownish or purplish green, conduplicate at the base; blade thin, 8–25 cm long, 1–2.4 cm wide, oblong-lanceolate; apex asymmetric, acute. **Inflorescence** a lateral panicle with

1 or more fractiflex, densely and successively flowered primary branches, 15–35 cm long including the peduncle; ovary with pedicel 1–1.3 cm long, subtended by subulate bracts 2-4 mm long. Flowers green or brownish, ca. 2.2 cm high, 1.3 cm wide. Sepals somewhat fleshy, dissimilar; dorsal elliptic, obtuse, 9-13 mm long, 4 mm wide; lateral connate forming an abaxially 2keeled, elliptic-ovate, emarginate synsepal 1-1.8 cm long, ca. 5 mm wide. Petals adnate to base of sepals, triangular-lanceolate, carinate, lightly reflexed, ca. 9 mm long, 3 mm wide. Lip obovate, convex, lightly retuse, apiculate, ca. 6-7 mm long, 4-5 mm wide; callus of 2 rounded pads near the middle. Column erect, fleshy, broad, 5-6 mm long, forming a nectary at the base; foot 2-3 mm long; apex with a pair of concave wings; anther papillose; pollinia 2, fleshy, translucent, with intensely red squarrose stipe and viscidium.

Epiphytic in lowland tropical and premontane rain forests at (50)750–1300 m. Flowering mostly January to April, September, and perhaps throughout the year. Endemic to Costa Rica.

Systeloglossum costaricense differs from S. acuminatum Ames & C. Schweinf. in the more exposed pseudobulb, more densely flowered inflorescence branches with shorter, subulate floral bracts, the column foot less than half the column length, the tendency for broader leaves, and the plants suffused with purple or brown.

Ticoglossum Halb.

(D. E. Mora de Retana)

REFERENCE—F. Halbinger, Cymbiglossum, Ticoglossum, and Rhynchostele. Orquídea (Méx.) 8: 155–282. 1983.

Epiphytic, cespitose to rhizomatous herb, roots grayish, somewhat velvety. Pseudobulbs compressed, ancipitous, discoid to ovoid, subtended by 2–4 foliaceous bracts; apex 1-foliate. Leaves conduplicate, elliptic-lanceolate, petiolate, acute. Inflorescence a lateral, scapose raceme borne at the base of the pseudobulb, with 1–5 flowers; ovaries terete, pedicellate, subtended by ovate, acute floral bracts. Flowers showy, white or rose. Sepals elliptic to ovate, apiculate. Petals subequal to the sepals, usually with a short, wide claw. Lip free, with claw and a fleshy callus. Column stout, straight; pollinia 2, conicreniform, with stipe and viscidium. Fruit an ellipsoid capsule.

A small genus of but two recognized species, both occurring in Costa Rica. Chase and Palmer suggest that *Ticoglossum* is related to the *Lophiaris* clade (mule ear oncidiums) of subtribe Oncidinae and especially to *Palumbina* and *Rossioglossum*.

Key to the Species of Ticoglossum

Ticoglossum krameri (Rchb. f.) Rodriguez ex Halb., Orquídea (Méx.) 9:5. Odontoglossum krameri Rchb. f., Gard. Chron. 98, t. 1868. TYPE: Costa Rica, Kramer sub Veitch (holotype: w, photo seen). The following names are based on white-flowered specimens (types not seen). Ticoglossum krameri var. smithianum (Rchb. f.) E. A. Christenson, Lindleyana 6:47. 1991. Odontoglossum krameri var. smithianum Rchb. f., Gard. Chron. 19(ser. 1):242. 1883. Odontoglossum krameri var. album Rolfe, Orch. Rev. 1:200. 1893. Ticoglossum krameri var. album (R. L. Rodr. C. ex Halb.) Halb. Odontoglossum krameri var. album R. L. Rodr. C. ex Halb. Orquídea (Méx.) 8: 186. 1982. Figure 46D.

Plant epiphytic, cespitose to 25(30) cm high. Rhizome short; roots to 2 mm in diameter. Pseudobulbs ovate-elliptic, strongly compressed laterally edges sharp, 3-5 cm long, to 4 cm wide, subtended by 3-4 subulate, nonfoliaceous bracts, 1-foliate apically. Leaves coriaceous, the base with petiole to about 4-5 cm long; blade elliptic-oblong, 13-22(28) cm long, 1.5-4 cm wide, the apex acute, somewhat apiculate. Inflorescence a lateral raceme of 2-4(5) flowers, 20-25 cm long including the scape; ovary with pedicel (3.5)4-5 cm long. Flowers white or light lavender with yellow callus, the dorsal sepal with yellow spot at the base. Sepals subequal, sessile, elliptic-ovate, apiculate, 1.3-1.7 cm long, 5-7 mm wide. Petals elliptic-oblong, united to the base of the column with a short, broad claw, 1.5-2 cm long, 8-10 mm wide; apex obtuse, lightly apiculate. Lip suborbicular to trapezoid, somewhat concave, about 1.5 cm long, 1.4 cm wide; apex emarginate; callus basal, somewhat elevated, base with 2 projections, apex with 2 teeth. Column stout, 8-9 mm long, somewhat broadened apically, without wings, but variously auriculate; pollinia 2, ovate, waxy, with stipe and viscidium. Capsule ellipsoid, without beak, 5 cm long, pedicel 3 cm long.

Epiphytic in premontane and montane cloud forests at 850–1100 m, but Halbinger reports 600–1200 m. Flowering February to September and November. Costa Rica; also reported from Nicaragua and Panama.

This species is easily distinguished from higher-elevation *T. oerstedii* (Rchb. f.) R. L. Rodriguez ex Halb. by the usually 3–5-flowered inflorescence and flowers with lip usually shorter than the sepals. Even when not in flower, the strongly

ancipitous pseudobulbs and relatively short petiole easily distinguish *T. krameri* from *T. oerstedii*.

Ticoglossum oerstedii (Rchb. f.) R. L. Rodr. C. ex Halb., Orquídea (Méx.) 9:5. 1983. *Odontoglossum oerstedii* Rchb. f., Bonplandia 3:214. 1855. TYPE: Costa Rica, Volcán Irazú, *Warscewicz 689* (holotype w, photo seen). Figure 47A.

Plant epiphytic, occasionally terrestrial, cespitose herbs. Rhizome short; roots to 2 mm in diameter. Pseu**dobulbs** ovoid, suborbicular, thick 1–3.5 cm tall, 1–1.5 cm wide, subtended by 2-4 nonfoliaceous bracts, apically 1-foliate. Leaves with petiole to ca. 1/2 the blade length; blade coriaceous, elliptic, acute, strongly keeled abaxially, 3–13 cm long, 1–3 cm wide. **Inflorescences** lateral, with 1 (rarely to 3) flowers, the scape 2–5 cm tall; ovary with pedicel 3–5 cm long, much longer than the subtending acute floral bract 6–12 mm long. Flowers white, callus spotted with orange, lip with orange in front of callus. Sepals similar, elliptic, 9-16(20) mm long, 6-9 mm wide, acute to obtuse. Petals obovate, obtuse, 1-1.7(1.9) cm long, 5-8(14) mm wide. Lip basally adnate to the column, obovate-flabellate, cuneate, deeply emarginate, 2-2.5(2.7) cm long, 1.2-1.6(1.8) cm wide, with an elevated W-shaped callus, the central point pubescent. Column stout, 6 mm long; pollinia 2, with long stipe and viscidium. Capsule ellipsoid, with short beak, 2-2.5 cm long with pedicel 1.8-3 cm long.

Epiphytic in premontane and lower montane rain forests at 1400–3000 m, where it grows on somewhat shaded median branches or in duff in deep shade beneath bamboos. Flowering throughout the year. Costa Rica; also reported from Panama.

Ticoglossum oerstedii differs from related T. krameri (Rchb. f.) R. L. Rodr. C. ex Halb. in the less compressed pseudobulbs, long petiolate leaf, and the single (rarely two), differently shaped flowers of the inflorescence. Flower size is extremely variable. One herbarium specimen (AMES 32911) includes one flower more than 5 cm tall. Apparently there is little or no overlap in the vertical distribution of the two species.

Trichocentrum Poeppig & Endl. (F. Pupulin & D. E. Mora de Retana)

Herb a cespitose epiphyte with reduced rhizomes. Pseudobulbs usually inconspicuous, ovoid to suborbi-

cular, generally concealed by scarious bracts. Leaves single, occasionally in pairs, articulate, sessile, coriaceous to fleshy, ovate, oblong-elliptic to ligulate. Inflorescence a lateral raceme or few-branched panicle with 1-many flowers, often successive. Flowers often large, showy, and sometimes fragrant. Sepals and petals free, similar, spreading. Lip adnate to the column base producing a conic or gibbous spur; blade with or without calli or lobules near the base. Column short, stout, adnate to the lip, auriculate or winged above, without a foot; pollinia 2, on a triangular stipe with reflexed margins. Fruit a capsule.

A Neotropical genus of about 25 species distributed from southern Mexico to Brazil, Bolivia, and Peru. Ten species are reported from Central America, eight of which occur in Costa Rica.

Cladistic analysis of data based on DNA (Chase & Palmer, 1992) strongly suggests close relationships within the *Lophiaris* clade, including *Oncidium* sect. *Cebolletae* Lindl. and *O.* sect. *Plurituberculata* Lindl.

Key to the Species of Trichocentrum

la.	Spur conic or cylindric, not lobed
	3b. Lip cuneate, somewhat obovate, fleshy and with plain apical margin; lateral lobes short and rounded
lb.	Spur 2- or 4-lobed
	4a. Anther cap glabrous T. caloceras
	4b. Anther cap papillose or hirsute
	5a. Column wings obtuse with incurved apices
	5b. Column wings with ascending or porrect apices, acute, usually somewhat revolute, never
	incurved
	6a. Inflorescence erect to spreading, flowers small, tepals ≤ 6 mm long; lip lightly narrowed in the middle
	6b. Inflorescence pendent, flowers medium to large, tepals ≥ 15 mm long, lip never nar-
	rowed in the middle
	7a. Lip shorter than sepals, elliptic-ovate
	7b. Lip longer than sepals, broadly rhombic T. cymbiglossum

Trichocentrum brenesii Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:248. 1923. TYPE: Costa Rica, San Pedro de San Ramón, 1200 m, *Brenes 116* (drawing: AMES). Figure 48C.

Plant epiphytic, small, to ca. 10 cm high. Rhizome short; roots filiform, flexuous, glabrous. Pseudobulbs nearly obsolete, scarcely 3 mm long, 1-foliate. Leaf suberect, obliquely ligulate, subacute, abruptly subpetiolatenarrowed toward the base, to 9 cm long, 1.5 cm wide. Inflorescence single, erect-spreading or spreading, with a single flower; peduncle concealed by a few sheaths at the base, the rest naked; ovary with pedicel glabrous, 1.2 cm long, floral bract ovate, shortly acuminate, $\leq \frac{2}{3}$ as long as the ovary. Flowers generally small, glabrous, thin in texture. Sepals ligulate, acute, 3-nerved, 6 mm long; lateral sepals oblique. Petals obliquely ligulate, somewhat acute, 3-nerved, 5 mm long. Lip oblong, subobtuse, somewhat narrowed in the middle, rounded at the base, smooth, glabrous, with short subtruncate spur 6 mm long, 2.75 mm wide at the base, 3.25 mm wide above the middle. Column short, 2 mm long, with 2 upward, obliquely subfalcate-elliptic, apiculate, entire wings; anther dorsally densely papillose-verruculose, rounded-cucullate.

Epiphytic in the moist premontane forest of Cordillera de Tilarán, San Ramón, and San Jerónimo at 1000–1200 m. Flowering time incompletely known; at least September (type). Endemic to Costa Rica, where it has been collected only three times. The above description is translated from Schlechter's original.

Although the type of *T. brenesii* was destroyed, a copy of Schlechter's drawing is kept at AMES and clearly shows the critical characters of the species: the lip slightly narrowed in the middle, not emarginate, and not longer than the sepals; the narrow sepals; and the apiculate column wings. Lip shape should prevent any confusion with *T. capistratum*, which has an elliptic-ovate, concave, carinate lip with undulate margins, whereas *T. brenesii* has a perfectly flat lip, lacking any keel or callosity.

Trichocentrum caloceras Endres & Rchb. f., Gard. Chron. 1257. 1871. TYPE: Costa Rica, *Endres*, not found (neotype: USJ *Pupulin & Castelfranco 1*; designated in Lindleyana 10:188. 1995). Figure 48A.

Plant a cespitose, pendent epiphyte. Rhizome short; roots filiform, glabrous. Pseudobulbs minute, rounded, 1-foliate, 2-2.5 mm long. Leaf fleshy, green spotted with purple, sessile, oblong to oblong-elliptic, 7 cm long, 1.4 cm wide, bluntly acute, somewhat minutely mucronate. Inflorescence a raceme 3-3.5 cm long including the terete scape and short, zigzag rachis, successively 5-6-flowered; floral bracts conspicuous, imbricate, ovate, cucullate, 4 mm long, acute; ovary with pedicel 8-10 mm long. Flowers small, spreading, with yellowish brown tepals; lip white marked with large purple blotches; anther white. Sepals dissimilar, elliptic-lanceolate, bluntly acute; dorsal erect, slightly concave, 1.1 cm long, 4 mm wide; laterals somewhat oblique, 1.2 cm long, 3 mm wide, apically carinate. Petals oblong-elliptic, obtuse, 1.2 cm long, 4-5 mm wide. Lip ovate-pandurate, adnate to the column base, carinate, 1.6 cm long, 8 mm wide; base cuneate forming a short, subquadrate, thickened spur of 4 lobes; apex retuse; callus of 2 thick keels converging at the base. Column 5 mm long, with 2 fleshy, rhombic, concave wings with revolute margins; anther cucullate, glabrous; pollinia 2, pyriform, with elongate, triangular stipe and a brown, peltate viscidium.

Trichocentrum caloceras grows either on twigs or on larger, shadier branches in premontane cloud forests at 900–1300 m. Flowering generally May to July. Southeastern Costa Rica and Panama.

Trichocentrum caloceras may be easily distinguished from its other Costa Rican relatives by the glabrous anther.

Trichocentrum capistratum Linden & Rchb. f., Gard. Chron. 1257. 1871. TYPE: Costa Rica, Wallis (w). Trichocentrum panamense Rolfe, Bull. Misc. Inform. 341–342. 1913. TYPE: Panama, Canal Zone, Lipscomb s.n. (K). Trichocentrum pusillum Lehmann, name only (K, MS). Figure 48D.

Plant epiphytic, pendent, cespitose. Rhizome short; roots slender, to about 1 mm in diameter. **Pseudobulbs** very short, 1-foliate. **Leaf** fleshy, oblong-lanceolate to elliptic-lanceolate, 4–7 cm long, 2 cm wide, gradually narrowed to a conduplicate, sessile base, apex acute. **Inflorescence** a pendent raceme of 3–7 successive flowers, 2–4 cm long including the zigzag rachis; ovary with pedicel 5–7 mm long, subtended by concave, triangular, acute bracts to 1.5 mm long. **Flowers** small with sepals and petals pale green or greenish yellow and lip white marked near the base with 2–4 reddish brown blotches. **Sepals** subequal, free, spreading, subcarinate, oblongelliptic to elliptic, 1.6–1.8 cm long, 3–4 mm wide, acute.

Petals oblong-elliptic, 1.4–1.6 cm long, 4–5 mm wide, acute. Lip adnate to the column, elliptic-ovate, concave, carinate, 1.6 cm long including spur, ca. 9 mm wide, with a short, obscurely 4-lobate, dorso-ventrally flattened spur at the base, acute, the basal margins somewhat undulate. Column short, stout, ca. 5 mm long, with a pair of porrect, fleshy, subquadrate, acute wings; anther cucullate, hirsute; pollinia 2, pyriform, compressed-concave; stipe flat, elongate, triangular; viscidium peltate, brown.

Trichocentrum capistratum is found in lowland and premontane evergreen forests at 500–1000 m, often growing low on twigs with roots in dense moss. It sometimes is found in bright light on the very smooth and dry bark of *Psidium guayava*. Plants have been observed in flower April to June, August, October, and November; to be expected throughout the year. Costa Rica to Colombia and Venezuela.

This species, while variable in leaf size and shape as well as scape length, is easily distinguished from similar *T. caloceras* and *T. costaricense* by the lack of spots on the lip and the presence of conspicuous trichomes on the anther.

Trichocentrum costaricense Mora-Retana & Pupulin, Selbyana 15(2):94. 1994. TYPE: Costa Rica, Alajuela, near Ciudad Quesada, about 700 m, *Horich s.n.* (holotype: USJ). Figure 48B.

Plant epiphytic, cespitose, pendent. Rhizome short; roots filiform, glabrous. Pseudobulbs short, rounded, cespitose, 1-foliate, ca. 3 mm long. Leaf fleshy, from a cuneate base, obovate-elliptic to elliptic-lanceolate, acute, sessile, 4 cm long, 1.7 cm wide. Inflorescence a raceme with green, terete peduncle, 2-3 cm long; rachis abbreviated, producing 2-3 flowers consecutively; ovary with pedicel linear-clavate, 8–10 mm long; floral bracts distichous, short, ovate, cucullate, 2 mm long, acute. Flowers spreading; tepals greenish white, lip white with lilac spots. **Sepals** similar, subcarinate, to 14 mm long; dorsal erect, obovate-oblong, acute to acuminate, 4 mm wide; lateral spreading, obliquely linear-lanceolate, acute, 2-2.5 mm wide. Petals obovate-oblong, 13 mm long, 4 mm wide, obtuse to acute. Lip elliptic, adnate to the column, concave, obtuse to retuse, carinate apically, 1.6 cm long, 10 mm wide, producing with the column base a short, flattened, truncate, obscurely 2-4lobed spur; callus consisting of a pair of obscure keels toward the base. Column short, stout, without a foot, ca. 5 mm long, with a pair of fleshy, incurved, subfalcate, obtuse wings; anther white, cucullate, papillose; pollinia 2, pyriform, concave, with elongate, triangular stipe; viscidium peltate, brown.

Epiphytic in the premontane rain and wet forests of Cordillera de Tilarán, both along the Central Pacific watershed and the Río San Carlos drainage. *Trichocentrum costaricense* is generally found on shady, constantly moist trunks and inner branches. Flowering October to January. Endemic to northern Costa Rica.

Trichocentrum costaricense differs from T. capistratum and T. caloceras in the fine purple spotting of the lip and in the incurved, obtuse, subfalcate wings of the column. The only other Costa Rican species with purple lip color is T. caloceras, which has an obovate-subpandurate lip, revolute margins of the column wings, and glabrous anther cap. Both T. capistratum and T. caloceras are more southerly species.

Trichocentrum cymbiglossum Pupulin, Lindleyana 9:51. 1994. TYPE: Costa Rica, Alajuela, Laguna Bosque Alegre, 750 m, *Pupulin 5* (holotype: USJ). Figure 49A.

Plant epiphytic, cespitose. Rhizome short; roots filiform, glabrous. Pseudobulbs minute, rounded, 1-foliate, about 4 mm long. Leaf dark green, fleshy, sessile, linearelliptic to elliptic, 5.3-7.5 cm long, 1.7-2.5 cm wide, obtuse to acute. Inflorescence a pendent raceme to 7 cm long; rachis short, zigzag, of 1-7 successively borne flowers; ovary with pedicel 4-7 mm long; floral bracts papery, distichous, ovate, cucullate, 6-7 mm long, acute. Flowers rather large, to 4.2 cm in diameter; tepals greenish white, free, spreading; lip white. Dorsal sepal elliptic-lanceolate, subcarinate, 1.5-1.9 cm long, 3-5 mm wide; apex acute, somewhat recurved; lateral sepals obliquely subfalcate, somewhat shorter than dorsal sepal, 1.35-1.8 cm long, 3 mm wide, acute. Petals oblanceolate-oblong, 1.87 cm long, 4.2-5 mm wide, apex acute and subcarinate. Lip adnate basally to the column, concave, carinate, broadly rhombic, 2-2.6 cm long including the short, flat, truncate, 4-lobed spur, 1.8 cm wide at the middle, apex retuse, margins undulate. Column stout, ca. 5 mm long, with a pair of erect-spreading, triangular, acute wings, apical margins erose; anther cucullate, white, papillose; pollinia 2, pyriform, concave, supported on a short triangular stipe; viscidium peltate, brown.

Usually epiphytic in medium or deep shade in very moist sites on small branches or trunks covered by dense moss mats in evergreen forests at 600–750 m. Flowering September to November. Endemic to Costa Rica; Atlantic drainage of northern and central Cordilleras and the high basin of the Río Reventazón.

The rhombic, concave lip, which is much longer than the sepals, is unique among species of Costa Rican *Trichocentrum*. Before its description, *T. cymbiglossum* had been accepted as *T. candidum* Lindl. (e.g., Icon. Pl. Trop. 15: t. 1495) but has a rhombic lip among other differences.

Trichocentrum dianthum Pupulin & Mora-Retana, Selbyana 15(2):90. 1994. TYPE: Costa Rica, Province of San José, Las Nubes de Quizarrá, 1988, flowered in cultivation March 1989, *J. Cambronero s.n.* (holotype: USJ). Figure 47B.

Plant epiphytic, cespitose, pendent. Rhizome short; roots filiform, glabrous. Pseudobulbs minute, rounded, to 5 mm long, 1-foliate. Leaf light green, sessile from a conduplicate base, oblong-elliptic to oblong-obovate, to 9.7 cm long, 3 cm wide, apex acute to minutely retuse. Inflorescence erect, simple or more commonly branched, 2-flowered in each branch; peduncle terete, green, 3.5-4 cm long; ovary with pedicel 2.3 cm long, linear-clavate; floral bracts conspicuous, ovate, concave, spreading, brownish, to 5 mm long. Flowers spreading, with tepals yellow covered by a very large brown blotch; lip white, marked near the base by 2 rose-purple blotches; column wings brown-striped, anther white. Sepals dissimilar, carinate; dorsal erect, ellipticoblanceolate, carinate, to 1.65 cm long, 6.3 mm wide, obtuse to subacute; lateral sepals spreading, obliquely oblanceolate, to 1.7 cm long, 4 mm wide. Petals linear-oblong, subcarinate, to 1.65 cm long, 5 mm wide, acute. Lip spatulate, adnate to column base, 2.5 cm long, 9.2 mm wide; lateral lobes at base narrow, falcate; midlobe rounded in front and with crisped margins; spur at the base elongate, slender, conic, 1.1 cm long. Column short, stout, to 5 mm long, with a pair of fleshy, erect, subquadrate wings; anther cucullate, hirsute; pollinia 2, pyriform, compressed, with short, triangular stipe; viscidium peltate, brown.

Rare epiphyte restricted to 1000–2000 m in the northern part of the Río General Valley, both in the watershed of the Fila Costera and the slopes of the Cordillera de Talamanca, and to the high western intermountain valleys of the Cerro Vueltas. Sometimes found on *Citrus* growing in thick moss of shady branches. Flowering February to April. Endemic to Costa Rica.

Trichocentrum dianthum may be easily distinguished by its long, conic spur and the heavy brown striping on the column wings.

Trichocentrum estrellense Pupulin & J. B. García, Lindleyana 10:195–197. 1995. TYPE: Costa Rica, Cartago, El Guarco, along a minor tributary of Río Reventazón, *F. Pupulin 209* (holotype: USJ). Figure 47D.

Plant epiphytic, cespitose, pendent. Rhizome short; roots filiform, glabrous, silvery white. **Pseudobulb** cylindric, to 10 mm long, 5 mm wide, 1-foliate. **Leaf** light green, sessile from a conduplicate base, linear-elliptic to elliptic-oblong, 8–12(20) cm long, 2.5–3 cm wide, obtuse to retuse. **Inflorescence** pendent, 3-many-flowered, successive, sometimes branched at the base; peduncle terete, 4–11.5 cm long, concealed by 2–3 concave, ovate bracts; ovary linear-clavate, ca. 3 cm long including the pedicel. **Flowers** large for the genus, tepals free, ivory

white with narrow chestnut brown blotch on the lower 1/3; lip white marked near the base by 2 rose-purple bars; column wing margins spotted and blotched with brown; anther white. Sepals dissimilar, obtuse to retuse; dorsal obovate-elliptic, to 1.6 cm long, 8.5 mm wide, slightly concave apically; lateral sepals obliquely elliptic, to 1.6 cm long, 6.5 mm wide, apex subcarinate and slightly concave, with short, rounded apicule. Petals linear-elliptic, 1.6 cm long, 6.5 mm wide, slightly concave apically. Lip adnate to the column base, obovate-subpandurate, 2.1 cm long, with short linear claw 2 mm long abruptly expanding to the blade, with 2 broad, subquadrate, pubescent basal lateral lobes; apex deeply emarginate; margins smooth, entire, producing with the column base a very short, blunt, saccate spur 2.6 mm long, 3.5 mm wide. Column short, stout, 3 mm long, with a pair of short, erect, subfalcate, lacerate wings; anther cucullate, papillose; pollinia 2, pyriform, rugulose, with short triangular stipe; viscidium elliptic, brown.

Epiphytic in premontane or tropical lowland rain forests at 450–1450 m. Known from the Atlantic slopes of Cordillera de Talamanca, where it grows on shady branches and moss-covered trunks mainly over streams. Flowering June to September. Endemic to Costa Rica.

The obovate, fleshy lip with plain apex, the short and rounded lateral lobes, and successive inflorescence distinguish *T. estrellense* from close relatives.

Trichocentrum pfavii Rchb. f., Gard. Chron. (n.s.) 16:70. 1881. TYPE: Chiriquí (probably Panama), Pfau 60 (w). Trichocentrum pfavii var. zonale Rchb. f., Gard. Chron. (n.s.) 19:44. 1883. Trichocentrum saundersianum Endres & Rchb. f., name only (w, Ms). Trichocentrum saundersii Endres & Rchb. f., name only (w, Ms). Trichocentrum zonale Rchb. f., name only (w, Ms). Figure 47C.

Plant epiphytic, cespitose, pendent. Rhizome short; roots slender for the genus, glabrous. Pseudobulbs minute, rounded, \leq 5 mm long, covered by a brown sheath, 1-foliate. Leaf light green, fleshy, sessile from a conduplicate base, oblong-elliptic to oblong-ovate, 7.2–12.5 cm long, 1.4-3.8 cm wide, obtuse to retuse. Inflorescences 2–4, pendent to suberect, shorter than the leaves, frequently branched at the base, mostly 2-flowered; peduncle terete, ≤ 5.1 cm long, concealed by 2-3 spreading, ovate, concave bracts; ovary linear-clavate, ca. 2 cm long including the pedicel. Flowers large and showy, tepals free, spreading, white with large median brownrose blotch; lip white marked basally by 1-2 rose-purple blotches; anther white. Sepals dissimilar, somewhat concave; dorsal elliptic-ovate, to 1.5 cm long, 8 mm wide; apex rounded to emarginate, sometimes with a dorsal apicule; lateral sepals obliquely elliptic-lanceolate, 1.5 mm long, 6 mm wide, subcarinate and thickened through the middle, apex obtuse and minutely apiculate. Petals spatulate, to 1.4 cm long, 6 mm wide, obtuse. Lip adnate to the column, cuneate-flabellate, 2.2 cm long, 1.6 cm

wide, with cuneate claw 5 mm long, the base with 2 narrow, erect, falcate, pubescent lateral lobes, expanding abruptly to the suborbicular blade, producing with the column base a very short, blunt, saccate spur 3 mm long. Column short, stout, ca. 5 mm long, with a pair of large, erect-spreading, subquadrate, rounded wings spotted brown along the margins; anther hemispheric, papillose; pollinia 2, pyriform, on a short, triangular stipe; viscidium peltate, brown.

Epiphytic on small branches with persistent, dense foliage and on moss-covered vines close to water in premontane and lower montane rain forest at 800–1500 m. Flowering November to March. Panama (Chiriquí) to Costa Rica in Valle de Coto Brus and Valle del General and along the Pacific slopes of the Cerro de la Muerte and Cerro Vueltas just to the region of Dota northward.

This species could probably be divided into two geographic races; one distributed from Panama to the northern limits of the Valle del General and the other inhabiting the medium intermountain valleys in the region of Dota. This last race generally presents a markedly narrower lip and a darker, brown color on the tepals.

Trichopilia Lindl.

(D. E. Mora de Retana)

Epiphytic and mostly cespitose herb. Rhizome short; roots cylindric, white. Pseudobulbs suborbicular, ovoid to linear-oblong, often much compressed, with nonfoliaceous sheaths at the base, apex 1-foliate. Leaves coriaceous, conduplicate, elliptic to lanceolate, acute. Inflorescence lateral, a raceme or flower solitary. Flowers large and often very showy, usually white to yellow variously marked with purple or red. Sepals similar, narrow, imbricate in bud, sometimes twisted, the lateral sepals sometimes variously connate to about the middle, margins usually undulate. Petals similar to the sepals. Lip simple or 3(4)-lobate, shortly adnate to the column, lateral lobes usually inrolled around the column; midlobe usually emarginate; margins often crispate, dentate, or undulate; callus usually with 1-3 keels. Column erect, semiterete, the base without a foot, anther bed dentate to fimbriate; pollinia 2, waxy with stipe with viscidium. Fruit a capsule.

A Neotropical genus of about 30 species of low to intermediate elevations. Six species are known in Costa Rica. Sterile plants or plants in fruit are usually easily distinguished by the nonfoliaceous, often spotted sheaths at the base of the apically 1-foliate pseudobulbs.

According to Chase, *Trichopilia* is closely related to *Helcia* and *Neoescobaria*, a clade that is somewhat isolated in the Oncidinae.

Key to the Species of Trichopilia

1a. Pseudobulbs suborbicular to subquadrate, to at most 2 times as long as wide
2a. Inflorescence with a single yellowish white flower
2b. Inflorescence with 2 or more white flowers with purple spotted lip T. suavis
1b. Pseudobulbs linear, usually more than 3 times as long as wide
3a. Flowers yellowish white, without reddish or brown spots
4a. Flowers 2–5 per inflorescence
4b. Flowers usually 1 per inflorescence
3b. Flowers with brown or reddish spots; sepals free or united only at the base 4
5a. Sepals and petals tinged with brown; lip white with brown spots
5b. Sepals and petals white or yellow tinged with red; lip white, lined, tinged, or spotted with
red 5
6a. Lip white tinged variously with red and with white margin T. marginata
6b. Lip yellow, with reddish brown, more or less irregular longitudinal spots
T. galeottiana

Trichopilia galeottiana A. Rich. & Gal., Ann. Sci. Nat. Bot. ser. 3, 3:26. 1845. TYPE: Mexico. (κ, photo seen). ?Trichopilia picta Lemaire, Ill. Hort. 6:86–87, t. 225. 1859. TYPE: Mexico. Figure 50C.

Plant a compact, cespitose epiphyte, to ca. 30 cm tall. Rhizome short; roots 1–2 mm in diameter. **Pseudobulbs** subcylindric, ancipitous, 8-12 cm long, 1.2-2 cm wide, subtended by grayish bracts becoming papery with age, 1-foliate apically. Leaves elliptic-lanceolate, carinate abaxially, 16-25 cm long, 3-5 cm wide, apex acute. Inflorescences lateral, pendent, 3-4, each with a solitary flower; ovary with pedicel 2.7 cm long, subtended by 3 papery, obtuse bracts. Flowers with greenish yellow sepals and petals with an interrupted reddish brown stain near the midvein; lip yellowish white with reddish brown spots apically and at the base of the lateral lobes, the lamina with a saffron-yellow spot centrally. Sepals subequal, elliptic-lanceolate, acute, carinate abaxially, 4.5-5 cm long, 1-1.2 cm wide, acute; dorsal erect, free; laterals shortly connate and recurved. Petals similar to the sepals but broader, 4.5-5 cm long, 1-1.5 cm wide. Lip 3-lobate, trumpet-shaped, 5.5-7 cm long, 2-4 cm wide in natural position; lateral lobes rounded, overlapping and embracing the column, midlobe broadly emarginate, recurved apically; callus sulcate along the midvein, with 2 hollowed areas laterally. Column subterete, 2-2.2 cm long, with fimbriate anther bed; pollinia 2, with viscidium and stipe.

Epiphytic, growing on larger branches in premontane rain forests at 1000–1200 m. Flowering May to July. Mexico to Costa Rica; perhaps also Panama.

This species is similar to *T. marginata* but has yellow flowers with ovary subtended by three broad bracts, and the sepals and petals are nearly flat.

Trichopilia maculata Rchb. f., Bonplandia. 3: 215. 1855. TYPE: Port Chagres (Panama?), *Keferstein ex Behr* (type not found). Figure 49B.

Plant a cespitose epiphyte 15-20 cm tall. Rhizome short; roots ≤ 2 mm in diameter. Pseudobulbs ellipticoblong, ancipitous, 5-7 cm long, 1-1.4 cm wide, the base enveloped in 3-4 spotted, imbricate bracts, apex 1foliate. Leaves subcoriaceous, elliptic-lanceolate, 16-20 cm long, 3.5-4 cm wide, acute. Inflorescence usually solitary, slender, arcuate or somewhat pendent; scapes 4–6 cm long. Flowers of moderate size, white, lip pale yellow with orange-red centrally. Sepals subequal, free or connate near the base, broadly spreading, lanceolate, often somewhat twisted, 2.5-3 cm long, 3-5 mm wide. **Petals** similar to the sepals, lanceolate, 2.5–3 cm long, 3-5 mm wide, acuminate, with undulate margins. Lip shortly adnate to column base, obscurely 3-lobate, obovate when spread, 3.5-3.7 cm long, 1.6-2.2 cm wide, narrowed at the base; lateral margins rounded, convolute, forming a tube; midlobe emarginate, with spreading or reflexed lobules; callus with a short, inconspicuous, central keel. Column slender, semiterete; apical margins distinctly 3-parted and minutely denticulate; pollinia 2, with stipe and viscidium. Immature capsule 3 cm long.

Epiphytic in premontane rain forests at 100–400 m. Flowering May to July. Costa Rica and Panama; also doubtfully reported from Guatemala and El Salvador.

Trichopilia maculata is similar to T. tortilis but has yellow-green flowers with a yellow lip, and the sepals and petals are nearly flat. The pseudobulbs are invested with several heavily spotted bracts.

Trichopilia marginata Henfr., Gard. Mag. Bot. 3:185, t. 1851. TYPE: New Granada. *Trichopilia coccinea* Warsc., Paxton's Fl. Gard. 2:79. 1851. TYPE: Costa Rica, *Warscewicz* (w, photo

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seen). *Trichopilia crispa* Lindl., Gard. Chron. 342. 1857. TYPE: Probably Costa Rica, based on Warscewicz collection, *Rücker* (K, photo seen). Figure 50B.

Plant epiphytic, cespitose. Rhizome abbreviated; roots 1-2 mm in diameter. **Pseudobulbs** subcylindric, slightly tapering, laterally flattened, 1-foliate, 4–12 cm long, 1–3 cm wide, covered at the base when young by several bracts turning papery with age. Leaves coriaceous, elliptic-lanceolate, 10-25 cm long, 2.5-5.5 cm wide, conduplicate at the base, the apex acute and recurved. Inflorescences 1-3 borne laterally at the base of the pseudobulb, each consisting of a single flower borne on a short scape, pendulous; ovary and pedicel strongly curved, 2-3 cm long. Flowers 8-14 cm in diameter, variable in color; sepals and petals yellowish green with a band of reddish brown centrally; lip white spotted with wine red to entirely red with white margins. Sepals similar, twisted, linear lanceolate, 7.5–8 cm long, 1-1.3 cm wide, acute and lightly conduplicate at the apex; lateral sepals very shortly connate at the base. Petals similar to the sepals but somewhat broader, 6.5-7 cm long, 1.5-1.8 cm wide. Lip tubular, 3-lobate, 6-7 cm long, 3.5-4 cm wide when spread; lateral lobes clasping the column, separated from the midlobe by a shallow sinus; midlobe rounded and emarginate; callus poorly defined, an intense yellow furrow at the base. Column semiterete, clavate, greenish at the base, white at the apex, 2.5-3 cm long, provided apically with a prominent anther bed with lacerate margins; pollinia 2, waxy, with stipe and viscidium; stigma entire, cordate.

Epiphytic on the shady trunks of trees in premontane and lower montane rain forests at 1200–1500 m. Flowering December to July. Reported from Nicaragua to Colombia.

Trichopilia marginata is distinguished from similar *T. galeottiana* A. Rich & Gal. by the solitary white and wine red flowers with crisped sepals and petals.

Trichopilia suavis Lindl., Paxton's Fl. Gard. 1: 44. 1850–1851. TYPE: Central America, *Loddiges* (κ, photo seen). *Trichopilia kienastiana* Rchb. f., Gard. Chron. n.s. 20:166. 1881. TYPE: *Kienast* (w, photo seen). Figure 49C.

Plant epiphytic, shortly creeping to cespitose. Rhizome short; roots 1–2 mm in diameter. Pseudobulbs fleshy, ovoid to suborbicular, laterally flattened, 4–7.2 cm long, 3.5–6.2 cm wide, apically 1-foliate, protected at the base by several spotted bracts becoming papery with age. Leaves subcoriaceous, broadly elliptic, forming a conduplicate petiole at the base, the apex acute, 4.5–30 cm long, 3.8–8.2 cm wide. Inflorescence a lateral, short, arcuate or pendulous, 2–5-flowered raceme supported on a short peduncle; ovary and pedicel 3.5 cm long. Flowers with a fragrance similar to sweet peas, white with rose spots. Sepals similar, the laterals shortly connate, elliptic-lanceolate, the margins undulate, 3.3–

5.2 cm long, 8–10 mm wide, with a prominent keel abaxially on midvein. **Petals** similar to the sepals but broader, 3–5.2 cm long, 1–1.2 cm wide. **Lip** obscurely 3-lobate, tubular or horn-shaped in natural position, quadrate when expanded, adnate to the base of the column, 4.8–7 cm long, 3.5–4.8 cm wide, lateral lobes involute and clasping the column, apex retuse; margins undulate or crisped, disk of the lip with a prominent keel. **Column** elongate, terete, with a conspicuous lacerate anther bed at the apex; pollinia 2, waxy, with prominent stipe and viscidium.

Epiphytic on large branches and trunks in premontane rain forests at 550–1300 m along both Pacific and Atlantic slopes. Flowering February to April; rarely to May. Reported from Costa Rica to Colombia.

Trichopilia suavis has large, white, fragrant flowers with fragrance of sweet peas, and the lip is spotted with rose or purple. Occasionally white forms are seen. Trichophilia suavis is suspected of hybridizing with T. marginata Henfr. at its lowest elevations, where the two species are sympatric

Trichopilia tortilis Lindl., Nat. Syst. Bot. (ed. 2) 446. 1836. Edwards's Bot. Reg. 22: t. 1863. 1836. TYPE: Mexico, *Barker* (K, photo seen). Figure 50A.

Plant epiphytic, cespitose. Rhizome abbreviate; roots 2-3 mm in diameter. Pseudobulbs oblong to cylindric, compressed, 5.5-7 cm long, 1.5-2 cm wide, the base concealed by one or more bracts spotted with brown, apically 1-foliate. Leaves subcoriaceous, elliptic-lanceolate, abaxially carinate, forming a conduplicate petiole at the base, apically acute, 8-15 cm long, 3.5-4 cm wide. Inflorescence a short scape with a single flower borne laterally at the base of the pseudobulb; ovary and pedicel curved, 3 cm long. Flowers 10-13 cm across; sepals and petals greenish white with a brown longitudinal band centrally for its entire length; lip white with brown spots. Sepals and petals similar, linear-lanceolate, acute to acuminate, strongly twisted and with undulate margins, 5.5-7.5 cm long, 8-12 mm wide. Lip adnate to the base of the column, obscurely 3-lobate, the side lobes involute and clasping the column forming a tube at the base, 5.5-6.2 cm long, 4-5.2 cm wide when spread, elliptic-suborbicular, emarginate; disk with a pair of excavated areas near the column apex. Column white, semiterete with fimbriate, tripartite anther bed; pollinia 2, with prominent stipe and viscidium.

Reportedly uncommon epiphyte of premontane rain forests of the Atlantic slope at 1000–1200 m, where it has been collected in Zapotal de Perez Zeledón. The Costa Rican forms are somewhat larger than those from farther north. Flowering April to June. Reported from Costa Rica but seen only in live collections.

Trichopilia tortilis differs from *T. maculata* by the strongly twisted sepals and petals, larger pseudobulbs, and the brown-spotted lip.

Trichopilia turialbae Rchb. f., Hamburger Garten-Blumenzeitung 19:11–12. 1863. TYPE: Costa Rica, *Wendland* (w, photo seen). Figure 49D.

Plant a cespitose epiphyte. Rhizome short; roots about 2 mm in diameter. Pseudobulbs ovoid-lanceolate, compressed, 6-9 cm long, 2.5-3.5 cm wide, 1-foliate. Leaves coriaceous, elliptic, acute, with prominent keel abaxially, 18-25 cm long, 4-6 cm wide, short-petiolate, acute. Inflorescence a short, lateral, 2-5-flowered, raceme 8-11 cm long; ovary with pedicel 4-4.5 cm long, subtended by a triangular floral bract about 3 cm long. Flowers not spreading widely, membranaceous, shortlived, 4.4-5 cm long, 1.5-1.8 cm wide in natural position. Sepals similar, elliptic-lanceolate, acuminate, 4 cm long, 4-5 mm wide; dorsal free, recurved; laterals ca. 3/3 connate, the apices somewhat recurved. Petals similar to the dorsal sepal but somewhat broader and with undulate margins, 4-4.5 cm long, 7-9 mm wide. Lip adnate to the base of the column, 3-lobate, trumpet shaped with upcurved, tubular base, 4-5 cm long, 3-4 cm wide when spread; midlobe emarginate and reflexed; lateral lobes inrolled around the column; callus of 3 elevated keels centrally. Column subterete, 1.5 cm long, with 3 fimbriate projections apically; pollinia 2, waxy, pyriform, compressed, with prominent viscidium and stipe.

Epiphytic in premontane rain forests at 600–1200 m. Flowering October to January. Nicaragua to Panama; also reported from Colombia.

Trichopilia turialbae is easily distinguished in Costa Rica by the rather small creamy white flowers, borne 2–5 per inflorescence. Also, the tepals are nonspreading. It has been confused by authors with *T. galeottiana* A. Rich. & Gal., but that species has larger flowers with essentially flat, spreading, much broader sepals and petals.

Trizeuxis Lindl.

(D. E. Mora de Retana)

Plant a psygmoid epiphyte. Stems short, pseudobulbs small, suborbicular, compressed, concealed by several leaves arranged in a fan, apically 1-foliate. Leaves articulate, fleshy, conduplicate, equitant, falcate. Inflorescence lateral, paniculate, each branch apex densely flowered. Flowers very small, subglobose. Sepals dissimilar, concave, shortly united at the base, lateral sepals connate to near the bifid apex. Petals elliptic-ovate, concave at the base, obtuse to bluntly acute. Lip simple or obscurely 3-lobate, apex fleshy and recurved, margins erect and parallel with the column. Column stout, widened at the

apex, with neither foot nor wings; anther terminal; pollinia 2, waxy, with simple elongate stipe and viscidium. Fruit a capsule.

A Neotropical genus of a single widespread species ranging from Costa Rica to Bolivia, Brazil, and the West Indies.

On the basis of the flowers, *Trizeuxis* seems related to *Ionopsis*, a relationship supported by the molecular data of Chase and Palmer.

Trizeuxis falcata Lindl., Coll. Bot. t. 2. 1823 (neither description nor type seen). Figure 50D.

Plant epiphytic often on twigs, forming small clumps, to ca. 8 cm tall. Rhizome short; roots large for the plant, to 1 mm in diameter. Pseudobulbs small, suborbicular, compressed, 1-1.2 cm long and high, the base covered by 2-4 leaves, apically 1-foliate. Leaves articulate, fleshy, conduplicate, falcate, 5-12 cm long, 5-8 mm wide (deep), acute. Inflorescence lateral, paniculate, exceeding the leaves; ovary with pedicel 1.2 mm long. Flowers minute, subglobose, yellow-green with orange lip. Sepals dissimilar, shortly united at the base; dorsal concave, elliptic-ovate, 3-3.2 mm long, 2-2.3 mm wide, obtuse; lateral sepals connate to near the bifid apex, 3-3.2 mm long, 1-1.1 mm wide. Petals similar to the dorsal sepal, concave at the base, elliptic-ovate, obtuse or subacute. Lip simple or obscurely 3-lobate, 4-4.2 mm long, 2-2.2 mm wide, lateral margins erect and parallel with the column, apex fleshy and recurved; callus sulcate, consisting of a pair of fleshy lateral projections to beyond the middle. Column stout, broadened apically, to 2 mm long; anther terminal; pollinia with well-developed stipe and viscidium.

Uncommon epiphyte of twigs and smaller branches, usually of disturbed evergreen forests at 50–900 m. Often seen growing on citrus, hibiscus, and coffee. Flowering February to April. Widespread from Costa Rica to Bolivia, Brazil, and the West Indies.

Trizeuxis falcata is easily recognized by the densely clustered, tiny, bell-shaped flowers and the plant with equitant leaves.

Warmingia Rchb. f.

(J. T. Atwood, based on reference below)

REFERENCE—B. Johansen, Warmingia margaritacea sp. nov. (Orchidaceae) from Costa Rica and a review of the genus. Lindleyana 7:194–198. 1992.

Plant a cespitose epiphyte. Pseudobulbs present, subtended by nonfoliaceous bracts; apex 1-foliate. Inflores-

cence a lateral few-flowered raceme. Flowers white or white with yellow. Sepals subequal. Petals usually rhombic and dentate, broader than the sepals. Lip 3-lobate, the lateral lobes usually rounded and dentate, the midlobe elongate. Column elongate, anther lacking a conspicuous anther bed; pollinia 2, with short or elongate stipe and viscidium. Fruit a capsule.

A Neotropical genus of about four species with scattered distribution in Bolivia, Brazil, Costa Rica, and Ecuador.

Warmingia is closely related to Macradenia, a genus with green to red flowers and usually a flared, variously dentate anther bed. The DNA work of Chase and Palmer show a close relationships of these genera with Notylia and Macroclinium.

Warmingia margaritacea B. Johans., Lindleyana 7:194–196. 1992. TYPE: Costa Rica, Turrialba, C.A.T.I.E., 600 m, *Johansen & Sørensen* 138 (holotype: C, not seen).

Plant an epiphytic herb to 7 cm high. Roots white, smooth, 1 mm in diameter. Pseudobulbs small, of a single internode, conic to ovoid, 7-8 mm tall, 3-4 mm wide, covered with 3-4 withering brown sheaths. Leaves dark green, coriaceous, lanceolate, somewhat falcate, 3.5-6 cm long including the 0.6-1.0-cm-long petiole, 1-1.7 cm wide. Inflorescence a lateral, pendulous raceme, to 3 cm long, with 2-3(4) flowers; bracts triangular, 6 mm long, 3 mm wide at the base; ovary with pedicel 8-9 mm long. Flowers ivory white and semiopaque; apparently autogamous. Sepals similar; dorsal slightly concave, elliptic-lanceolate, 8 mm long, 3 mm wide with a carinate, acute apex; lateral sepals slightly falcate, 7 mm long, 3 mm wide. Petals rhombic, 8 mm long, 5 mm wide, apex slightly carinate, margins denticulate-erose to somewhat crispate. Lip 3-lobate just above the base, 8 mm long, 9 mm wide across the lateral lobes when spread, with erose-serrate margins; lateral lobes erect, transversely elliptic to reniform, 3 mm long, 5 mm wide; midlobe broadly ovate, 8 mm long, 3 mm wide; callus 2-lobate, deeply sulcate, appearing to originate from the base of the sidelobes. Column terete to semiterete, 3 mm long, 1 mm wide, slightly expanded and with 2 appendages at the apex; anther ovate with a decurved truncate apex; pollinia with short stipe and viscidium. Capsule ellipsoid to obovoid, 12 mm long, 8 mm wide.

The above description is quoted and paraphrased directly from the original description because the species is known only from the holotype. Warmingia margaritacea was originally found growing on a cultivated hibiscus hedge at Turrialba (600 m) and must have originated from elsewhere, where it is hopefully more common. Endemic to Costa Rica, where it is reported to be autogamous.

Warmingia margaritacea should be easily recognized by the small plants and white flowers with dentate petals and lip. They may have been overlooked because of their small size or, alternatively, may be extremely rare.

Addendum to Subtribe Maxillariinae

One new species of *Maxillaria*, published by I. Bock in *Die Orchidee*, appeared as this work was in press. In addition, one other new species, authored by J. T. Atwood, is currently in press in *Selbyana*.

The first species, Maxillaria admonens I. Bock (Orchidee 48:105-107, 1997), should be compared to M. gomeziana J. T. Atwood (p. 59). Bock claims that M. admonens differs in the broader egg-shaped pseudobulbs, the more compact plant, and by the lip forming a sharper angle with the column foot. At this time we cannot confirm or reject this as a new species but note that the diagnostic drawings resemble M. gomeziana, remembering that plant habits are generally variable in Maxillaria. Flower color patterns of M. admonens evident in the separations are very similar to those of flowers from which the holotype of M. gomeziana was prepared. The illustration provided by Bock shows the same central keel in the callus that is consistent with both M. bracteata and M. gomeziana; therefore M. admonens cannot be excluded from those taxa on this character alone.

On page 72 a reference is made comparing specimen *Mora 60* (INB) to *M. mombachoensis* Heller ex J. T. Atwood. The specimen differs from that species in the shorter peduncles, shorter ovaries, and the shorter and remarkably thick leaves. This species, apparently a narrow Costa Rican endemic, was published shortly after the present work had gone to press. The description of it is paraphrased below.

Maxillaria cacaoensis J. T. Atwood, Selbyana 19: 254–255. 1999. TYPE: Costa Rica. Province of Guanacaste: Cantón of Liberia, Cordillera de Guanacaste, Cerro Cacao, Estación Cacao, 1100 m, A. Mora 60 (holotype: INB: isotype: SEL). Figure 51.

Plant cespitose, apparently densely so, to about 10 cm tall; roots to ca. 2 mm in diameter. Pseudobulbs coarsely rugose in dried specimens, semiorbicular, com-

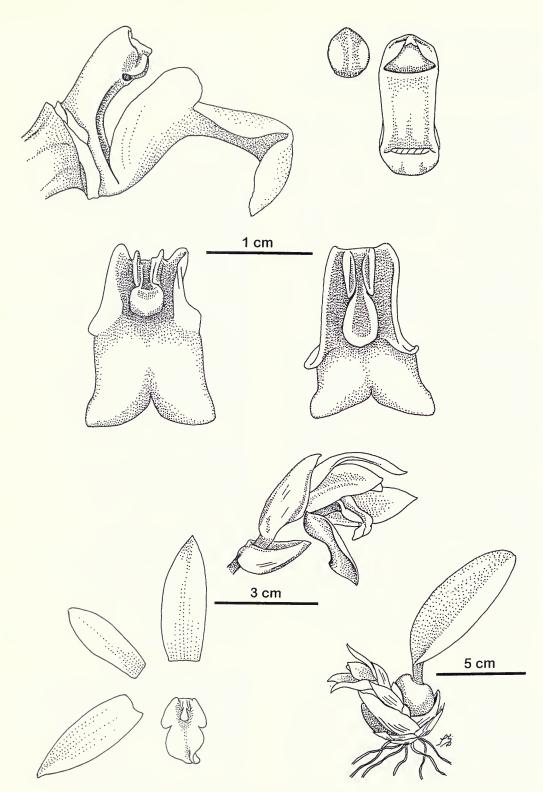


Fig. 51. Maxillaria cacaoensis.

pressed, 2-3.5 cm long, 2.5 cm wide, subtended by sheaths that are apparently bladeless; apex 1-foliate. Leaves coriaceous, strongly keeled beneath especially apically; blades 6-9 cm long, 2-3 cm wide in the type, obtuse. Inflorescences short; scapes ca. 3 cm long, concealed by inflated bracts; ovary about 1.5 cm long, concealed by the subtending floral bract. Flowers campanulate to somewhat spreading, yellowish orange with white at the base of the sepals and petals; lips reddish. Sepals ovate-lanceolate, 3.5 cm long, 1.5 cm wide, acute. Petals elliptic-oblanceolate, acute, 2.8 cm, 1 cm wide. Lip hinged to the column foot, sharply 3-lobate at about \% from the base; lateral lobes rounded in front, somewhat clasping the column; midlobe fleshy, ovate, recurved to somewhat reflexed, ca. 1.8 cm long, 1.4 cm wide in natural position, bluntly acute to obtuse; calli 2, of 2 keels in front ending just below the base of the midlobe. Column stout, nearly straight, ca 1.4 cm long, including anther; foot 5-6 mm long; anther ca. 4 mm.

Known only by the type collection from a cloud forest on Cerro Cacao in northern Costa Rica at 1100 m. Flowering at least in January and February, according to the collection date.

Maxillaria cacaoensis is most similar to Nicaraguan M. mombachoensis J. T. Atwood in flower color and in the large floral bracts, but has a much shorter ovary and noticeably shorter and thicker leaves. There may be yet another closely related undescribed species on Volcán Maderas in Lake Nicaragua with smaller flowers. Apparently, isolation on these mountaintops enables the separate populations to develop identifiably distinct traits. Pollinators in this group are unknown, but the large, inflated floral bracts and fleshy orange to yellow flowers suggest pollination by humming-birds.

Maxillaria cacaoensis is a member of the difficult M. cucullata Lindl. complex, represented in Costa Rica by four species and in Panama by one. The following key, modified from page 39, should distinguish them in this area.

32a.	Flowers with trigonous ovaries, sepals and			
	petals greenish stained with purple			
	·	_	M. obscura	
32b.	Flowers otherwise			
	with maroon M. cedralensis			
	Xb.	Flowers otherwise Y		
		Ya.	Floral bract $> 1.5 \times$ ovary; flow-	
			ers unspotted M. cacaoensis	
		Yb.	Floral bract $< 1.25 \times \text{ovary}$,	
			flowers greenish or orangish,	
			with small spots arranged in lines	
			M. punctostriata	

Addendum to Subtribe Oncidiinae: Leucohyle Klotzsch

(Joaquín B. Garcia-Castro and D. E. Mora de Retana)

Plants generally epiphytic, cespitose and compact; rhizome short. Pseudobulbs small, especially in the Costa Rican species, cylindric or conic, truncate, with a single fleshy, linear or subterete and sulcate leaf. Inflorescence lateral at the pseudobulb base, pendent. Flowers small, attractive, with whitish or translucent ground color. Sepals and petals similar, slender and undulate, the lateral sepals free. Lip united to the base of the column, prominently concave and with irregular border. Column short, semiterete, apically with a hood with irregularly dentate margin; pollinarium with two pyriform pollinia, supported on a slender linear-lanceolate stipe and small viscidium.

A genus of only two accepted species distributed from Mexico to Brazil and the Antilles; one species in Costa Rica. Recent work of Norris Williams and Mark Whitten (unpublished) suggests a close relationship with *Trichopilia* Lindl., *Helcia* Lindl., and *Neoescobaria* Garay.

Leucohyle subulata (Sw.) Schltr., Die Orchideen 469. 1914. Epidendrum subulatum Sw., Prodr. Ind. Occ. 123. 1788. TYPE: West Indies (not seen). Cymbidium subulatum (Sw.) Sw., Nov. Act. Soc. Ups. 6:73. 1799. Trichopilia subulata (Sw.) Rchb. f. Flora 48:278. 1865.

Plant epiphytic, cespitose; rhizome short; roots 1-2 mm in diameter. Pseudobulbs fleshy, subconic to cylindric, 0.8-3 cm long, 2-5 mm broad, concealed at the base when young by several dark fibrous bracts; apex 1-foliate. Leaves fleshy, linear-lanceolate to semiterete, sulcate above, conduplicate at the base, apex acuminate, 8-25 cm long, 3-10 mm wide. Inflorescence pendent, a raceme of 3-8 flowers supported on a slender penduncle; ovary and pedicel slender, about 1.4 cm long; floral bracts papery, obovate-elliptic, acuminate, 9 mm long, 5 mm wide. Flowers small, translucent white with the lip spotted with red, especially near the base. Sepals subequal, linear-lanceolate, the apex mucronate, with undulate margin, 1.6-2.6 cm long, 2-4 mm wide. Petals similar to the sepals but somewhat shorter and broader, somewhat twisted, 1.5-2 cm long, 3-6 mm wide. Lip basally adnate to the column, simple, concave, rounded to subcordate, with irregularly denticulate margins, 1.5-2 cm long, 1.2-1.8 cm wide, apex apiculate; disc with a basal depressed, subquadrate callus continued in front by two lateral low keels and a somewhat more prominent central keel. Column semiterete, somewhat recurved; apex with a hood covering the anther, with irregular border.

This species is reported from Mexico and Nicaragua to Peru and Venezuela and the West Indies. It is known in Costa Rica from San Carlos, Province of Alajuela, and from Turrialba, Province of Cartago. It appears similar to a small trichopilia but has subconic-cylindric pseudobulbs in addition to more slender and more fleshy subterete leaves. The flowers are somewhat unusual for the unlobed concave lip and the column apex appearing apically hooded.

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